

Installation,
Operation, and
Service Instructions
with Parts Lists

CULLIGAN®
High Efficiency 1.5 Twin
Water Softener

Featuring the
Culligan® Smart Controller™
Models from 2012
Firmware Version 2.1.7



Attention Culligan Customer:

Your local independently operated Culligan dealer employs trained service and maintenance personnel who are experienced in the installation, function and repair of Culligan equipment. This publication is written specifically for these individuals and is intended for their use.

We encourage Culligan users to learn about Culligan products, but we believe that product knowledge is best obtained by consulting with your Culligan dealer. Untrained individuals who use this manual assume the risk of any resulting property damage or personal injury.

NOTICE Please send any suggestions for improving this manual to productmanuals@culligan.com



WARNING! Electrical shock hazard! Prior to servicing equipment, disconnect power supply to prevent electrical shock.



WARNING! If incorrectly installed, operated, or maintained, this product can cause severe injury. Those who install, operate, or maintain this product should be trained in its proper use, warned of its dangers, and should read the entire manual before attempting to install, operate, or maintain this product. Failure to comply with any warning or caution that results in any damage will void the warranty.



CAUTION! This product is not to be used by children or persons with reduced physical, sensory or mental capabilities, or lack of experience or knowledge, unless they have been given supervision or instruction.



CAUTION! Children should be instructed not to play with this appliance.



CAUTION! If the power cord from the transformer to the unit looks or becomes damaged, the cord and transformer should be replaced by a Culligan Service Agent or similarly qualified person in order to avoid a hazard.



WARNING! This device complies with Part 15 of the FCC rules subject to the two following conditions: 1) This device may not cause harmful interference, and 2) This device must accept all interference received, including interference that may cause undesired operation.

This equipment complies with Part 15 of the FCC rules. Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.



CAUTION! To reduce the risk of fire, use only No. 26 AWG or larger telecommunications line cord.

NOTE This system is not intended for use with water that is microbiologically unsafe or of unknown quality without adequate disinfection either before or after the system.

NOTE Check with your public works department for applicable local plumbing and sanitation codes. Follow local codes if they differ from the standards used in this manual. To ensure proper and efficient operation of the Culligan equipment to your full satisfaction, carefully follow the instructions in this manual.

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Installation, Operation, and Service Instructions with Parts Lists

Culligan® High Efficiency 1.5 Twin Water Softener

Featuring the
Culligan® Smart Controller™

Models from 2012

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Read this Manual First

Before you operate the Culligan® High Efficiency 1.5 Twin Water Softener, read this manual to become familiar with the device and its capabilities.

Culligan® High Efficiency 1.5 Twin water softener systems are designed to meet the needs of applications for high quality water. This manual contains important information about the unit, including information needed for installation, operating, and maintenance procedures. A troubleshooting section provides a guide for quick and accurate problem solving.

In order for the water treatment system to continue to provide high quality water, you must develop a thorough understanding of the system and its operation. Review this manual before making any attempt to install, operate, or service the system. Installation or maintenance done on this system by an untrained service person can cause major damage to equipment or property damage.

The HE 1.5 Twin Water Softeners are tested and certified by WQA against NSF/ANSI 372, CSA B483.1, and NSF/ANSI Standard 61 for material requirements only. They are not certified for Contaminant Reduction or Structural Integrity by WQA.

The HE 1.5 Twin Water Softener Control Enclosure complies with the UL 50/50E and UL 746C standards for a NEMA 3R Enclosure Rating.



About this Manual

This manual:

- Familiarizes the operator with the equipment
- Explains installation and setup procedures
- Provides basic programming information
- Explains the various modes of operation
- Gives specifications and troubleshooting information

Safe Practices

Throughout this manual there are paragraphs set off by special headings.

Notice

Notice is used to emphasize installation, operation or maintenance information which is important, but does not present any hazard. For example,

NOTICE The nipple must extend no more than 1 inch above the cover plate.

Caution and Warning

Caution is used when failure to follow directions could result in damage to equipment or property. For example,

 **CAUTION!** Disassembly while under water pressure can result in flooding.

Warning is used to indicate a hazard which could cause injury or death if ignored. For example,

 **WARNING!** Electrical shock hazard! Unplug the unit before removing the timer mechanism or cover plates!

The CAUTION and WARNING paragraphs are not meant to cover all possible conditions and situations that may occur. It must be understood that common sense, caution, and careful attention are conditions which cannot be built into the equipment. These MUST be supplied by the personnel installing, operating, or maintaining the system.

Be sure to check and follow the applicable plumbing codes and ordinances when installing this equipment. Local codes may prohibit the discharge of sanitizing or descaling solutions to drain.

Use protective clothing and proper face or eye protection equipment when handling chemicals or power tools.

NOTE The Culligan High Efficiency 1.5 Twin Water Softener is not intended for use with water that is microbiologically unsafe or of unknown quality without adequate disinfection either before or after the system.

NOTE Check with your public works department for applicable local plumbing and sanitation codes. Follow local codes if they differ from the standards used in this manual. To ensure proper and efficient operation of the Culligan High Efficiency 1.5 Twin Water Softener to your full satisfaction, carefully follow the instructions in this manual.

Smart Controller Features

The primary function of the Culligan Smart Controller is to initiate and control the regeneration process via methods that are most convenient and cost effective for the customer while offering many operational features and benefits. The controller is designed to operate a wide range of existing and new softener and filtration valves.

Take Control of Your System and Your Productivity

The Culligan Smart Controller is an advanced design engineered to handle regeneration and monitoring of your water treatment equipment. It offers powerful programming options that can be used to operate and monitor any softener or filter system. It also provides sensing capabilities, expanded communications and a multifunction keypad—all in one simple-to-use unit.

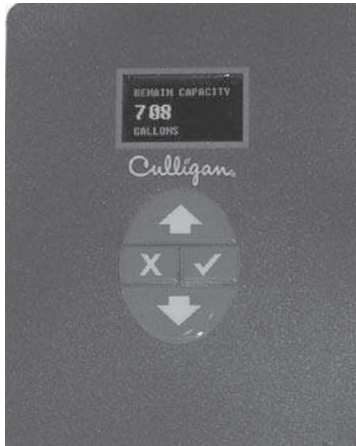


Figure 1. HE 1.5 Smart Controller.



Figure 2. Remote display.

Smart Controller Features

Feature	Use/Benefit
Advanced Lighted OLED Display	The user is guided through brightly lit graphical menu screens with clear, multi-line, full text prompts.
Membrane Keypad	The keypad uses sealed contacts for programming. No buttons to get dirty.
Program Beeper	Emits an audible beep when keys are depressed to help identify valid (short beep) or invalid (three short beeps) pushes. Can be enabled or disabled.
Power Source	Electrical power required is 24 Volt AC current. A UL listed plug-in transformer (120 V/60 Hz or 230 V/50 Hz) is provided.
Time of Day	Displays current time of day in either 12-hour or 24-hour format.
Real Time Clock with a Five-Year Battery Back-up	Keeps accurate time even during a power outage. Updates automatically when the Smart Controller is equipped with optional modem capability.
English or Metric Values	Displays can be set to either English or Metric units.
Regeneration Interval	Provides the ability to initiate a time clock regeneration based on a number of days (1 to 99) or a specific day of the week.
Regeneration Start Delay	Allows a user determined number of hours (0-9) to be set for the purpose of increasing the amount of time between regenerations in a multi unit installation.
Progressive Flow Trip Point	Allows multiple tank systems operating with flow meters to bring tanks on-line or off-line as facility flow demands increase or decrease.
Multiple Unit Communication	A communication cable interconnects multiple units to operate the controller in the Progressive Flow mode and prohibits them from regenerating at the same time.
Diagnostics	The user can check the operation of sensors, progressive flow communication, motor positions, or an optional wireless display.
Transformer is UL and CUL Listed	
RoHS Compliant	

Optional HE 1.5 Features

Feature	Use/Benefit
Flow Meter/Sensor Input	Supports various types of Hall effect flow sensors using a programmable K factor to initiate a regeneration sequence.
Aqua-Sensor® Input	Supports the patented digital Culligan Aqua-Sensor technology used to efficiently initiate and control a regeneration sequence.
Telephone Modem	<ul style="list-style-type: none"> • Calls in reports on regenerations and alarm conditions. • Automatically updates time and date when calling in.
Wireless Remote Display	Displays the current status of the unit. It can be located up to 200 feet away from the Smart Controller (depending on building and interference). The telephone modem can optionally be installed in the remote display.
Smart Brine Tank Probe	<p>This probe monitors conditions inside the brine tank.</p> <ul style="list-style-type: none"> • Predicts when more salt is needed. • Detects the presence of a salt bridge. • Detects eductor line plugging. • Signals brine tank overfilling condition.
Auxiliary Input	Capable of accepting a remote signal from a dry contact device such as an operator push button or an external alarm signal for the purpose of initiating a regeneration sequence, inhibiting a regeneration event, or to change the valve position to standby.
Auxiliary Output on Alarm	Capable of sending a signal when an alarm/error is recognized.
Expansion Board for Additional Outputs	<ul style="list-style-type: none"> • Control valves. • Control external solenoids or chemical feeders.

Basic Principles

What Is Hard Water?

Water is said to be hard when it carries too high a concentration of calcium and magnesium. Acceptable water hardness levels will vary depending on the application.

Why Should Hardness Be Removed?

Hard water causes scaling and etching which greatly impairs the life and efficiency of boilers, air-conditioning systems, cooling towers, water heaters, refrigeration plants and other equipment using water.

How Does It Work?

The components of dissolved minerals are called ions. They carry either a positive or negative charge. Hardness ions of minerals dissolved in water carry a positive charge. These positively charged ions (cations) are attracted to a synthetic softening material called ion exchange resin.

The heart of the softening system, therefore, is a deep bed of resin which draws calcium and magnesium ions, as well as ferrous iron, from the water as it passes through the resin bed.

Can The Resin Draw Out Hardness Ions Indefinitely?

No. During normal operation, the resin becomes saturated with positive ions and functions less efficiently. When hardness leakage occurs, the resin should be regenerated to restore its efficiency.

How Do You Regenerate Resin?

You regenerate a resin bed by removing the mineral ions through a process called ion exchange. This regeneration process occurs in four steps and takes approximately 80 to 90 minutes.

Backwash

During the backwash step, raw water flows rapidly upward (in reverse direction to the service flow) through the resin bed to expand the bed and flush out accumulated dirt, sediment and other sources of turbidity.

Brine Draw

The brine solution consisting of water and salt is drawn from a brine storage tank and allowed to flow slowly down through the resin bed. The brine solution removes the calcium and magnesium ions from the resin. This cycle can also be split into three "sub-cycles" which allow for the cost saving feature of brine reclaim.

Slow Rinse

Brine draw is then followed by a raw water slow rinse. This rinse step will slowly remove most of the remaining brine, exchanged calcium and magnesium ions from the resin. This cycle can also be split into three "sub-titles" which allow for the cost saving feature of brine reclaim.

Fast Rinse

Slow rinse is followed by a raw water flush, a very rapid down flow of raw water which removes the last traces of brine, and settles the resin bed.

How Often Must You Regenerate?

Frequency must be determined for each installation based on the amount of water usage, its degree of hardness and the amount of resin through which it flows. In some cases it is necessary to utilize a resin cleaner when the raw water contains iron. Contact your local Culligan dealer for more information.

How Do You Control The Regeneration Process?

The regeneration process for your commercial water softener is controlled automatically either on a predetermined time, volume, or external signal basis through the use of the Culligan Smart Controller with optional flow sensor. See the Installation chapter for further information. The regeneration process can also be initiated manually by the operator as required.

Modes of Operation

Time Clock

The controller will initiate a regeneration based upon a time schedule of either hours (between 1 and 24 hours), intervals of days (such as every three days) or on a specific day of week schedule (such as Mondays, Wednesdays, or Saturdays). Because regeneration will occur at the prescribed schedule regardless of water use, this method is usually the most inefficient method of water softener operation.

Flow Meter/Sensor

When a flow meter or sensor is connected to the controller circuit board, the controller has the ability to measure the amount of water treated and initiate a regeneration sequence based upon the user determined gallon capacity of the water softening equipment. The controller can also delay the regeneration signal until a convenient time of day (known as a delayed regeneration) or act and initiate the regeneration sequence as soon as the signal is received (known as immediate regeneration).

When installing an alternating duplex system (one tank on-line, the other in standby), only one flow measuring device is required to be installed in the common outlet header of the system. Parallel systems (multiple tank systems, all on-line simultaneously) require one flow device for each mineral tank in the system.

This method is a good, cost-effective means to operate a water softening system.




Aqua-Sensor® Sensing Device

The Aqua-Sensor® detects when a softener resin bed has reached its point of exhaustion and, as a result, initiate a regeneration sequence. This is the most cost-effective method of operation and may be combined with any of the operational modes previously described.

Regeneration Interval (Time Clock Backup Mode)

This setting provides regeneration when a set period of time has elapsed. If the meter or Aqua-Sensor does not trigger regeneration prior to the time clock backup value, the time clock backup will trigger the regeneration.

Manual Regeneration

Pressing and holding  for five (5) seconds will initiate a delayed regeneration. Pressing and holding  again for five (5) seconds will cancel the delayed regeneration. Pressing and holding  for ten (10) seconds will initiate an immediate regeneration. The regeneration statistics will not be updated if the last cycle of regeneration does not automatically complete. See page 68 for further details about the Manual Regeneration feature.

Bypass Mode

The HE softener can be bypassed for a preset time duration. See page 70 for further details about the Bypass feature.

Day-of-Week Regeneration

A regeneration can be programmed to occur on any day (or any combination of days) of the week. If for example the "Tuesday Regeneration Trigger" and the "Friday Regeneration Triggers" are turned "ON", then a regeneration will occur every Tuesday and Friday (in addition to any other regeneration triggers which may occur).

Predict Mode

The Predict Mode is used in the flow meter mode to determine the optimum regeneration point. Before the regeneration starts, the control will compare the remaining capacity value with the average daily water use. If the average daily water usage is less than the remaining capacity, the controller will wait 24 more hours before regeneration. If the remaining capacity is less than the average daily water usage, the control will initiate regeneration. This works in delay mode only.

Pre-Rinse Mode

The Pre-rinse mode is used to pre-rinse the softener resin bed or filter media. The pre-rinse in flow meter mode will occur after the control has sensed that no water has flowed through the control for a period of X hours (can be set through the

programming menu). When the control is in this mode, once the X amount of hours have elapsed the control will cycle to the fast rinse position for the pre-set length of minutes and then return to the home or service position.

Down Flow Regeneration

Water and regenerate flow downward through the media tank during regeneration.

Dial-a-Softness

Dial-a-Softness is a manual adjustment built into the control valve that allows for variable hardness bypass into the softened water. The hard water bypass can be adjusted from 1–3 gpg. The Dial-a-Softness also increases the softener capacity in proportion to the percent hard water bypass (less salt used). See page 17 for more information.

Twin Configuration

The Culligan HE 1.5 Twin provides uninterrupted conditioned water 24 hours per day. Two independent mineral tanks provide a continuous flow of soft water; when one tank is exhausted, the second tank takes over as the first regenerates. This system is particularly suited for situations where water is extremely hard.

Performance Specifications

Specifications for High Efficiency 1.5 Twin Water Softeners

Culligan commercial water softeners are designed to remove hardness minerals from water. In order to function properly, some operational parameters must be followed. They include:

1. An operating water pressure between 20 and 125 psi (138-862 kPa). If water pressure is greater, a pressure regulating valve should be installed ahead of the system. If water pressure is lower, additional equipment will be required to maintain a 25 psi minimum operating pressure.
2. Operating temperature between 33° and 120°F or 1°–49°C.
3. Clear (non-turbid) water supplies (Less than 5 NTU).

Model No.	Exchange Capacity (kgr) Per Tank		Service Flow Rate (gpm) Per Tank		Backwash Flow Rate (gpm) Per Tank	Minimum System WxHxD Dimensions (in.)
	Maximum (grains)	Minimum (grains)	Continuous @ 15 psi max. pressure loss	Peak @ 25 psi. max. pressure loss		
HE-060	60	40	25.1	31.5	5.5	58x60.1x16
HE-090	90	60	26.6	35.2	5.5	68x62.7x20
HE-120	120	80	23.3	31.8	5.5	68x74.7x20
HE-150	150	100	27.2	35.8	7	72x76.3x21
HE-210	210	140	28.0	37.4	11.5	78x77x23

Table 1. HE 1.5 Twin Specifications (U.S. units).

Model No.	Exchange Capacity (kgr) Per Tank		Service Flow Rate (lpm) Per Tank		Backwash Flow Rate (l/min) Per Tank	Minimum System WxHxD Dimensions (cm)
	Maximum (grains)	Minimum (grains)	Continuous @ 1 bar drop	Peak @ 1.7 bar drop		
HE-060	60	40	95.1	140.0	20.8	147x152x41
HE-090	90	60	100.8	143.8	20.8	173x157x51
HE-120	120	80	88.3	132.5	20.8	173x188x51
HE-150	150	100	103.1	135.5	26.5	183x193x53
HE-210	210	140	106.0	141.6	43.5	198x196x58

Table 2. HE 1.5 Twin Specifications (Metric units).

NOTE Dimensions assume systems include an optional, standard size brine tank. The measured width includes the supplied interconnecting pipe.

NOTE Allow a minimum of 24" above the overall system height for access into the top of tank(s).

Installation

NOTE Read this section carefully. Follow all local plumbing and electrical codes.

Each HE 1.5 Twin water softener contains the following item(s):

- FRP water softening media tanks.
- Control valves
- Media—refer to the table below for quantities of: Cullex Resin and Cullsan underbedding
- Manifold kit(s)

Included with valve:

- Meter
- 1½ NPT Plastic Adapter
- Softener Kit
 - Drain line flow controls
 - Brine connection coupling, tube fitting
 - Drain line fitting and clamp
 - Extra eductors
- Twin Small Parts Kit (P/N 01024819)
- Optional Brine tank
- Optional manual 1.5" bypass valve (P/N 0102XXXX)

Model Series	Qty Cullex (ft³)	Qty Cullsan (lbs)	Freeboard (inches)
HE-060	2	30	24
HE-090	3	40	27
HE-120	4	40	30.5
HE-150	5	70	30
HE-210	7	80	27.5

Table 3. Loading quantities.

Locate Softener

1. Select a space that is level and allows a sufficient amount of room above and behind the softener tank(s) for service access and plumbing supply and drain lines. Allow a minimum of 24 inches (61 cm) above the top of the system.

NOTE Upon initial installation or in the event the distribution pipe ever needs to be replaced, as much as 75 inches (191 cm) of clearance may be required above the tank if it is not possible to SAFELY lie the tank on its side for installation/replacement of this distributor.

2. Floor surface—Choose an area with a smooth, solid and level floor capable of supporting the operating weight of the softening system.
3. Drain facilities—A nearby drain must be capable of handling the water softener discharge flow rates during the backwash cycle of the regeneration process. Refer to the Specifications on page 7 for information concerning the backwash flow rate.
4. Screw the control assembly onto the empty media tank until it seats. Mark the front of the tank, then remove the control assembly.



CAUTION! Do not attempt to use any distribution part that is damaged. Doing so may create operational problems and/or create a substantial risk of consequential damage not covered by the product warranty.

Distribution System Installation

1. Locate the distributor components and carefully inspect them to be sure they have not been damaged from handling during transit.
2. Remove the cap/plug from the end of manifold and set aside for reuse.
3. Insert the manifold assembly into the tank. Use a straight edge and pencil to make a straight line on the manifold assembly flush with the top of the tank. See Figure 3 and Figure 4.
4. Remove the manifold assembly and squarely cut the manifold tube on the line drawn in step 3. De-burr the cut manifold assembly. Reinstall the cap and then plug into the end of the manifold tube.
5. Place the manifold assembly back into the tank.

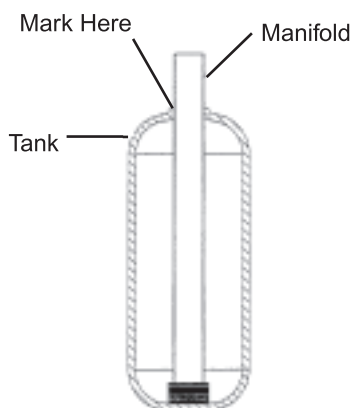


Figure 3. Manifold assembly.

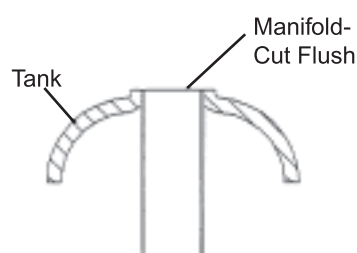


Figure 4. Installing laterals.

Load the Media and Install the HE 1.5 Twin Valve

Before the valve can be finally attached to the tank, the media (gravel and resin) must be loaded. Do not attempt to load the media without having the tank in its final position. Moving the tank once the media has been loaded will be difficult.

Load the Media

1. Do not proceed unless the distribution assembly has been installed as previously outlined.
2. The media will be loaded through the opening in the top of the tank. DO NOT allow media to fall into the distributor tube. Prior to loading the media tank, cover the tube with a bag; be sure to secure the cover in place. Do not allow the item covering the tube or any thing other than the media to fall in to the tank.
3. Keep the distributor tube as close to the center of the tank as possible while filling.
4. Add water until it is about six inches above the bottom of the manifold assembly. The water will cushion the distributor from the gravel as it is loaded.
5. Insert a large mouth funnel into the tank opening and pour the Cullsán underbedding into the tank.
6. Distribute the underbedding (Cullsán) as evenly as possible around the bottom of the tank. Additional water or a length of pipe/broom handle or board may be helpful with accomplishing this.

NOTE If you are planning on using an Aqua-Sensor® device for regeneration initiation, install it now on the lead unit only. See page 10 and page 25. See page 135 for programming instructions.
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7. Add the Cullex resin to the inside of the tank. Slowly fill the tank with water while rinsing any resin from the tank threads and/or manifold tube.
8. Remove the item previously installed to cover the distributor tube during the media loading process. Be sure there are no foreign objects in the tank.

Mount the Control Valve

1. Lubricate the O-ring on the bottom of the control with a silicone-based lubricant.
2. Install the inlet disperser to the bottom of the control valve.

3. Lower the control valve slowly onto the tank so that the distributor tube fits into the center of the control valve and then screw the control onto the tank. See Figure 5.

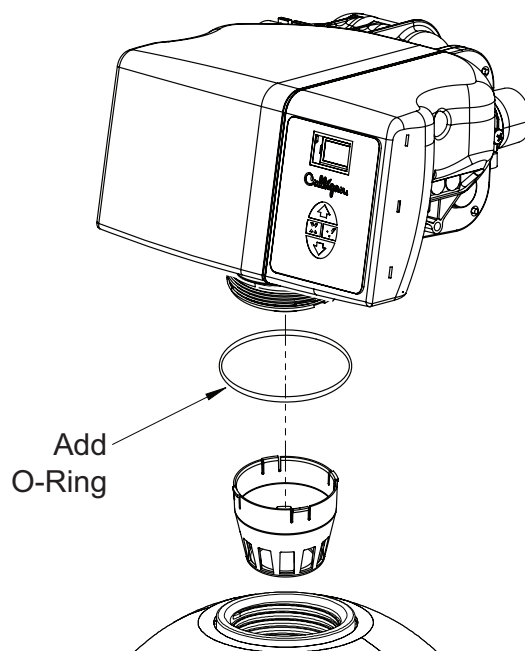


Figure 5. Mounting the control valve.

Aqua-Sensor® (Optional)

The Aqua-Sensor® (see Figure 6) is purchased as an optional item. This device detects and initializes a regeneration based on changes in the electrical conductivity of the resin bed. It shall also similarly detect reverse changes during the regeneration process so as to allow for optimum slow rinse times and potential water saving operation. Due to tank design limitations, the Aqua-Sensor® accessory CANNOT be used with the HE-150 or HE-210.



Figure 6. Aqua-Sensor® probe.



WARNING! For best results, do not subject the Aqua-Sensor® to conditions outside the operating parameters of the water softening system. See page 7.

The Aqua-Sensor® device is installed through the fillport located at the top of the tank. The plug must be removed. Needle nose pliers work best. It will be replaced with the fitting that is on the Aqua-Sensor® cord in the kit (see Figure 7). The fitting is removable by hand, although a screwdriver shank makes a good lever if extra force is needed.

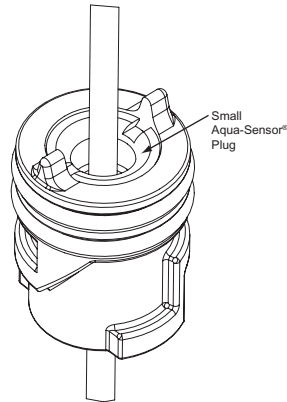


Figure 7. Aqua-Sensor® fitting.

Aqua-Sensor Installation

To install the Aqua-Sensor® probe, first determine the length of the Aqua-Sensor® cable to be placed inside the tank. See Table 4 for recommended lengths of each HE 1.5 Twin model. If greater system capacity is required before a regeneration signal is sent to the controller then the Aqua-Sensor® should be positioned just above the gravel sub-bed inside the softener tank (see Figure 8). Measure sufficient cable to allow the Aqua-Sensor® to hang in place within the resin bed but not so much that the probe would be in contact with the gravel sub-bed and potentially be damaged during the regeneration process. If adjustment is necessary, moisten the cable sheath and slide the cable grip up or down to the proper cable length.

NOTE During the backwash cycle the resin bed will be agitated, which will allow the probe to settle to a level equal to the overall length of the probe and cable. Do not leave more cable than necessary inside the tank. Any excess cable should be coiled near the controller, outside of the resin tank.

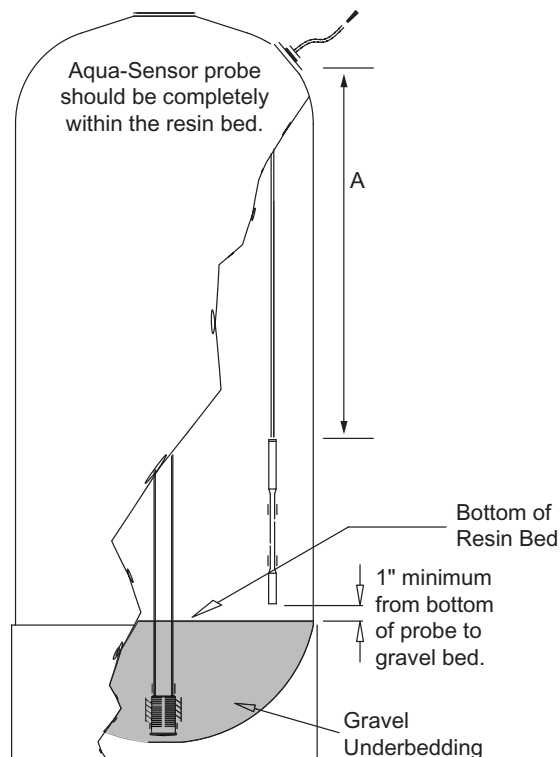


Figure 8. Aqua-Sensor® probe positioning.

NOTE The Aqua-Sensor probe is shipped from the factory at the recommended length for the HE-060 model.

Model	Recommended "A"
HE-060	41.0"
HE-090	41.0"
HE-120	46.0"
HE-150	33.0"
HE-210	26.5"

Table 4. Recommended Aqua-Sensor probe lengths.

Because of its unique capabilities, the Aqua-Sensor® can be positioned near the upper portion of the resin bed (providing greater reserve capacities normally required for delayed regeneration purposes), near the bottom of the resin bed (most common for immediate regeneration) or anywhere in between. Appendix B provides detailed information about Aqua-Sensor® Application Guidelines, resin bed depths and the estimated capacity per inch of resin bed depth at varying salt dosages.

Install Piping

1. Depending on the type of softener system and the installation parameters, required pipe lengths and piping accessories will vary. See Figure 9 to aid the installation. If the layout drawings are not sufficient for your application, consult the Culligan dealer for specific installation guidelines.

NOTE The use of unions and inlet and outlet isolation valves is recommended to facilitate the servicing of the system. It is also recommended a full flow by-pass line be provided.



CAUTION! All soldering **MUST** be done on any connections requiring soldering prior to connecting the main control valve. The main control valve will be damaged if it is connected at the time of soldering.

2. Follow good plumbing practices for installation. These include:
 - a. Check threads and make certain that they are clean and free of foreign matter.
 - b. Fittings must be free of cracks or chips.
 - c. Prepare threads with either a pipe dope sealant or Teflon tape.
 - d. Make certain that the fittings are not cross threaded during the assembly process.
 - e. Do not over-tighten fitting or threaded pipe being inserted into a cast or forged part.



CAUTION! Never connect two dissimilar metals (such as copper and steel) together. The use of dielectric unions or schedule 80 PVC or PVC plastic to break the connection is highly recommended in order to reduce the risk of galvanic reaction and subsequent corrosion.



CAUTION! The media tank must never be subjected to an internal vacuum or it might be damaged. Drain line suction can be prevented by piping the system in similar fashion to that shown in Figure 9. A vacuum breaker may be installed on either the inlet or the outlet side of the vessel as close to the vessel as possible, preferably between the vessel and any isolating valves. If an installation has a booster pump downstream of the vessel, install the vacuum breaker on the outlet side. Do not install a vacuum breaker on the drain line. Use a vacuum breaker, such as Culligan 00401584 or 01003701. Multi-tank systems will require at least one vacuum breaker per tank.

Suggested Piping Installations

The piping layouts below depict a traditional three-valve bypass. Culligan also offers an optional bypass valve that connects directly to the inlet and outlet of the water softener.

NOTE Interconnecting pipe and fittings, bypass valves, and isolation valves are not supplied.



CAUTION! DO NOT make a direct connection to the drain. Provide an air gap of at least four times the diameter of the drain pipe or conform to local sanitation codes and to permit the observation of drain flow.

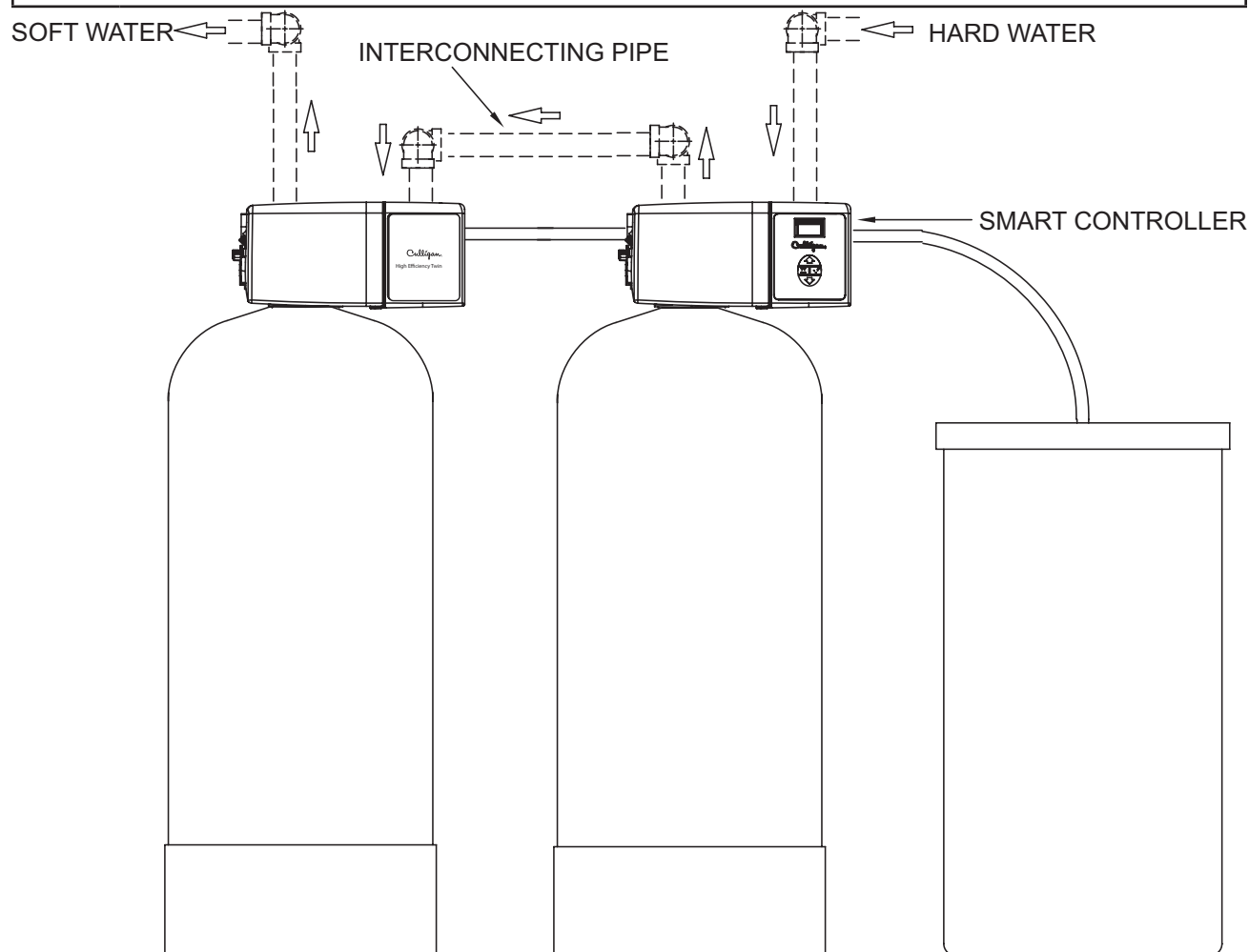


Figure 9.HE 1.5 Twin tank piping.

NOTE The base unit is set up for the 14" diameter, 60,000 grain system. If you are installing the 60,000 grain system, then no changes are required to the control. If you are installing any other size system, refer to Table 5 on page 14 for any additional changes. The items that are marked with an asterisk are already in the valve.

Backwash Flow Control, Eductor Nozzle—Throat

Use the recommended backwash flow control, eductor nozzle, and eductor throat for various size tanks. See Table 4.

NOTE Use the same setup for both valves.

Refer to Figure 10 through Figure 14 and instructions below for changing the backwash flow control, eductor nozzle, and eductor throat.

Model	Backwash Flow	Nozzle	Throat	Brine Refill Flow
HE-060	5.5 gpm*	Green*	Blue*	0.8 gpm
HE-090	5.5 gpm*	Green*	Blue*	0.8 gpm
HE-120	5.5 gpm*	Green*	Blue*	0.8 gpm
HE-150	7 gpm	Green*	Blue*	0.8 gpm
HE-210	11.5 gpm	Yellow	Blue	0.8 gpm
*Shipped assembled inside the control standard from factory				

Table 5. HE 1.5 injector settings.

Eductor Nozzle and Throat Replacement

Refer to Table 5, Figure 10 and the instructions below when changing the eductor nozzle and throat.

1. Remove the eductor cap clip.
2. Remove the eductor cap.
3. Remove the eductor assembly.
4. Remove the eductor screen from the assembly.
5. Remove the nozzle and eductor throat and replace it with the correct nozzle.
6. Make sure to put the O-ring on the nozzle.
7. Replace the eductor throat if required.
8. Reverse the procedure to reassemble.
9. For downflow regeneration, the arrow on the eductor cap should face down.

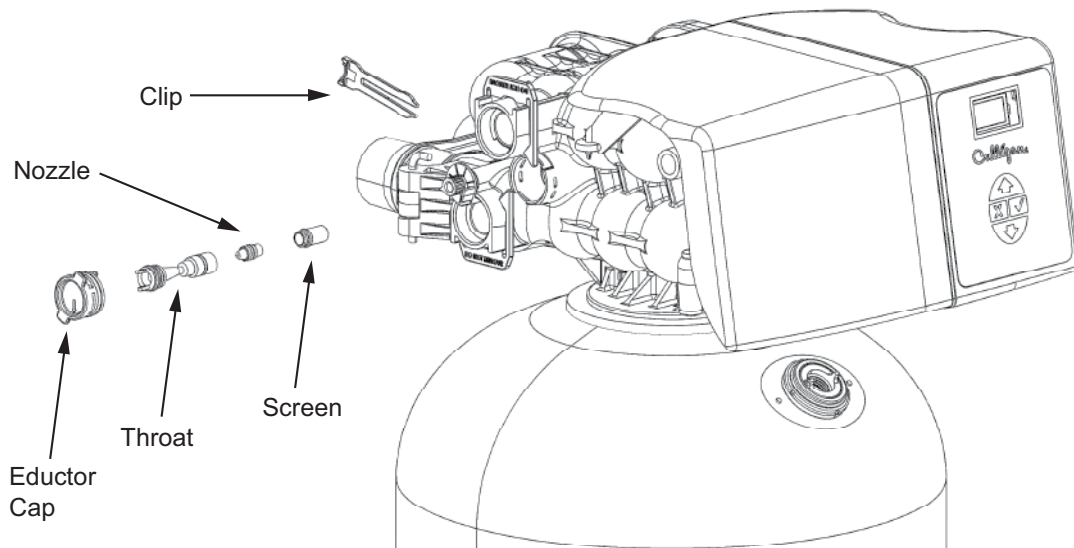


Figure 10. Removing the eductor nozzle and throat.



CAUTION! DO NOT make a direct connection to the drain. Provide an air gap of at least four times the diameter of the drain pipe or conform to local sanitation codes and to permit the observation of drain flow.

Backwash Flow Control Replacement

Refer to Table 5, Figure 13, and the instructions below to replace the backwash flow control.

1. Remove the cover by releasing the cover fastener from the control valve. See Figure 11 and Figure 12.
2. Remove the drain clip and pull off the drain elbow.
3. Remove the backwash flow control located behind the elbow.
4. Install the correct backwash flow control.
5. Reverse the procedure to reassemble.

NOTE The number on the flow control should face into the valve body.

NOTE Do not re-install the cover until the drain line tubing is connected.

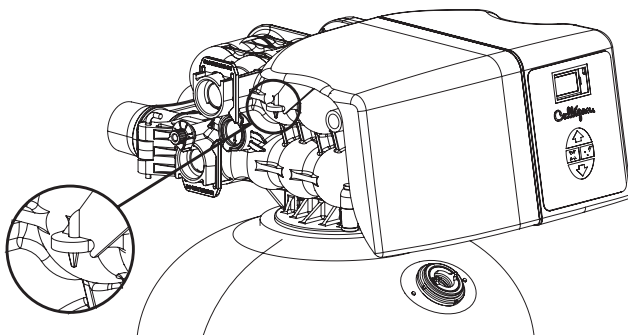


Figure 11. HE 1.5 Twin valve cover fastener clip.

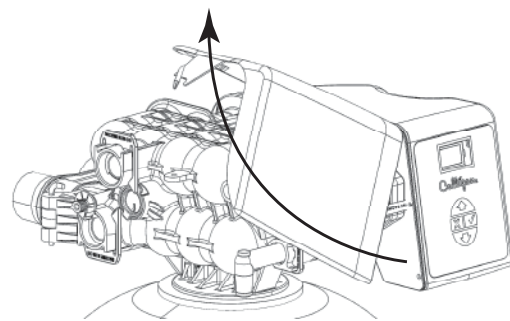


Figure 12. Removing the HE 1.5 Twin valve cover.

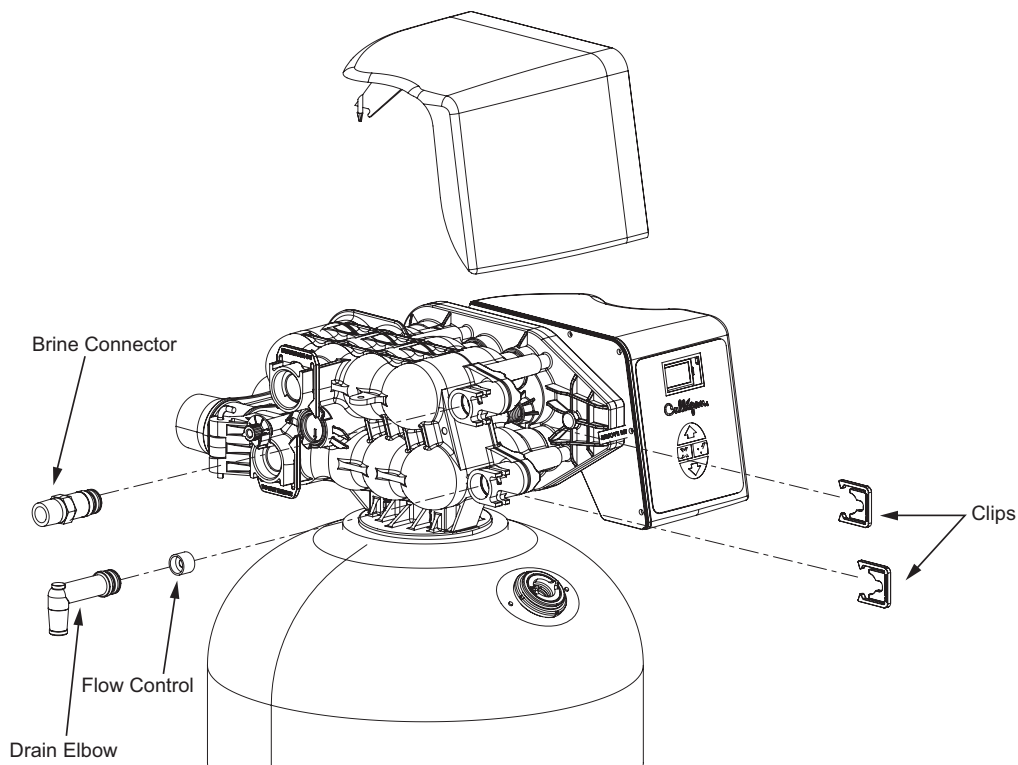


Figure 13. Replacing backwash flow control.

Attaching the Cover

Once the drain and brine line is connected re-attach the cover. Refer to the below instructions and Figure 14 through Figure 16.

1. Insert the two pins on the top of the cover into the two holes on top of the frame; the cover should be slightly angled. See Figure 14.
2. Rotate the cover downward inserting the two pins on the side of the cover into the two holes on side of the frame. See Figure 15.
3. Attach the cover fastener onto the control valve. See Figure 16.

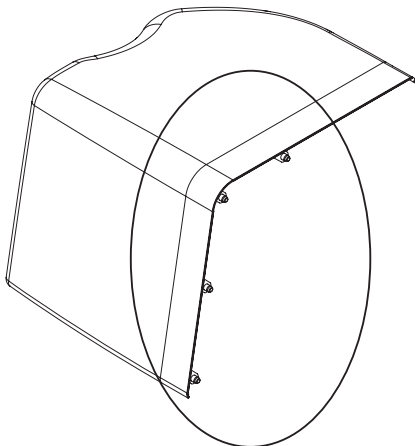


Figure 14. Cover fastener clip.

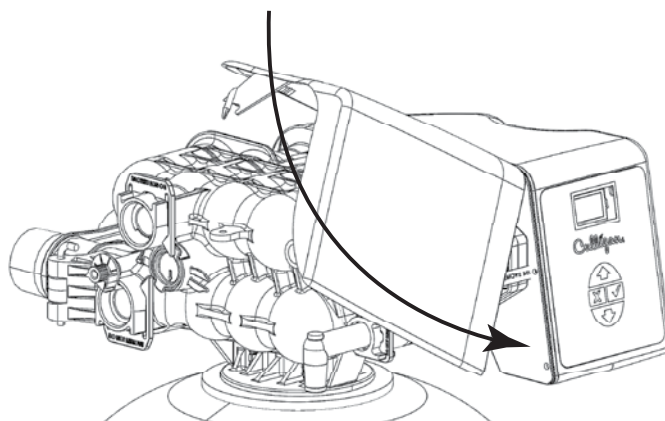


Figure 15. Reattaching the HE softener cover.

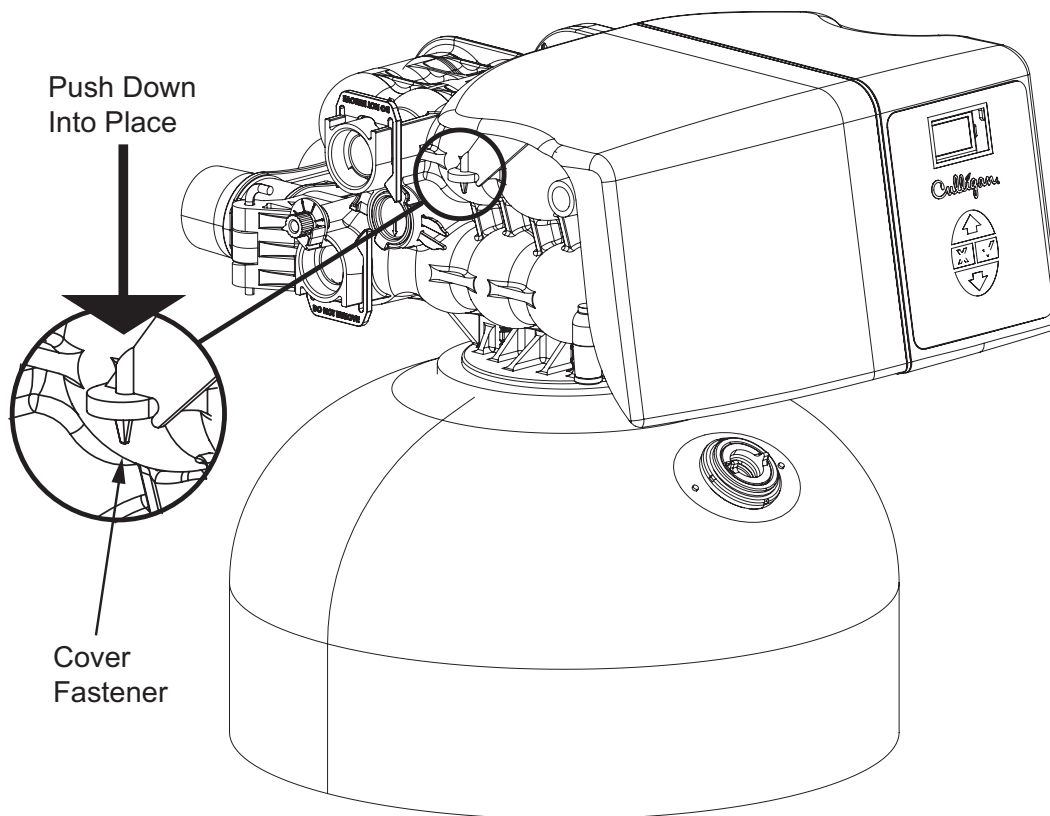


Figure 16. Reattaching the cover fastener.

Dial-a-Softness

Dial-a-Softness is a manual adjustment built into the control valve that allows for variable hardness bypass into the softened water. The hard water bypass can be adjusted to produce 1–3 gpg hardness bleed. Shipped from the factory the Dial-a-Softness knob is set to the “SOFTTEST” position (no hard water bypass). See Figure 17.

To set the Dial-a-Softness:

1. Locate the Dial-a-Softness knob on the control valve.
2. Set the Dial-a-Softness knob to position A, B, or C as outlined in the table below, based on raw water hardness; this should produce a 1–3 gpg hardness bleed.

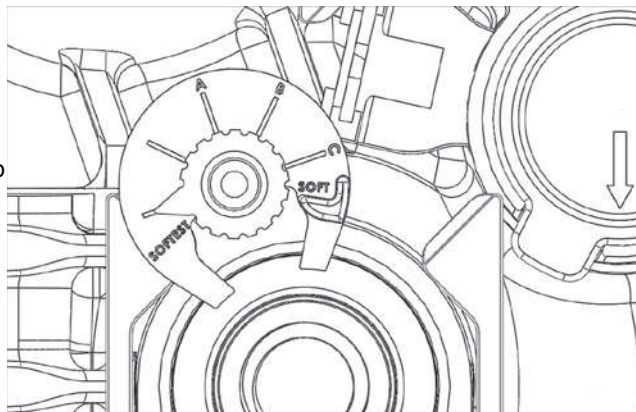


Figure 17. Dial-a-Softness knob.

Letter on Dial-a-Softness Knob	1–3 gpg Hardness Bleed
SOFTTEST	No Bleed
A	On between 20–30 gpg feed
B	On between 10–20 gpg feed
C	On less than 10 gpg feed

NOTE The HE 1.5 Twin must take into account the adjusted capacity if the Dial-a-Softness was changed. See Advanced System Setup to update the Dial-a-Softness setting.

Straight-Through Adapter

Shipped with each softener is a Culligan® straight-through adapter, which is used to connect the softener to the plumbing system.



CAUTION! Close the inlet supply line and relieve the system pressure before cutting into the plumbing! Flooding could result if not done!

Straight-Through Adapter Installation

Refer to Figure 18 and the instructions below to connect the meter, straight-through adapter, and interconnecting pipe.

NOTE Use the same setup for both valves.

1. All HE 1.5 Twin units are equipped with a meter. The meter is installed on the outlet side of the control valve. The meter body fits in the same space as the coupling between the control valve and the straight through adapter. Make sure the arrow on the flow meter is pointing in the direction of the flow.
2. The straight-through adapter connects directly to the control valve with the meter and coupling and two assembly pins. Lubricate all O-rings on the couplings/meter with silicone lubricant. See Figure 18.
3. Connect the interconnecting pipe. The interconnecting pipe is connected to the outlet of Control #1 and the inlet of Control #2.

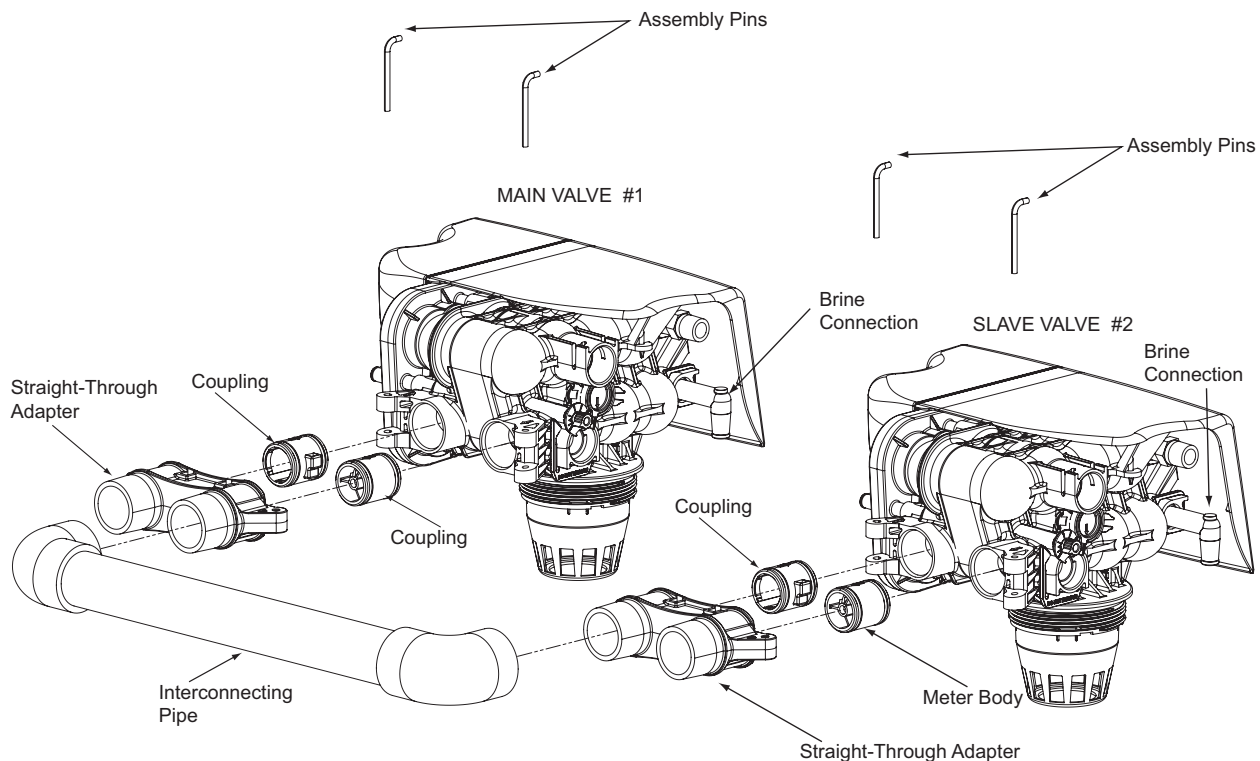


Figure 18. Straight-Through Adapter assembly.

NOTE If the ground from the electrical panel or breaker box to the water meter or underground copper pipe is tied to the copper water lines and these lines are cut during installation of the straight-through adapter, an approved grounding strap must be used between the two lines that have been cut in order to maintain continuity. The length of the grounding strap will depend upon the number of units being installed. In all cases where metal pipe was originally used and is later interrupted by the straight-through adapter to maintain proper metallic pipe bonding, an approved ground clamp c/w not less than #6 copper conductor must be used for continuity. Check your local electrical code for the correct clamp and cable size.

Optional Bypass Valve Installation

Refer to Figure 19 and the instructions below to connect the meter, bypass valve, and interconnecting pipe.

1. All HE units are equipped with a Soft-Minder® meter. The meter is installed on the outlet side of the control valve. The meter body fits in the same space as the coupling between the control valve and the bypass. Make sure the arrow on the flow meter is pointing in the direction of the flow.
2. The bypass valve connects directly to the control valve with the meter and coupling and two assembly pins. Lubricate all O-rings on the couplings/meter with silicone lubricant.

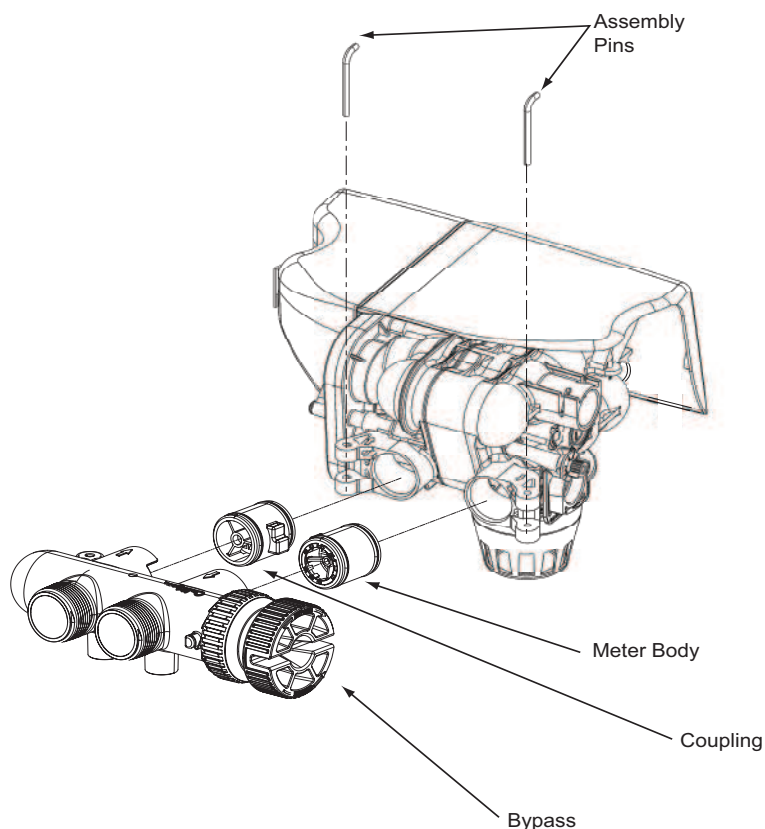


Figure 19. Bypass valve assembly.

Optional Bypass Valve Operation

To bypass, turn the blue knob clockwise (see directional arrow on end of knob) until the knob stops as shown. **DO NOT OVERTIGHTEN!** (Figure 20). To return to service, turn the blue knob counter-clockwise (see directional arrow on the end of knob) until the knob stops as shown. **DO NOT OVERTIGHTEN!** (Figure 21)

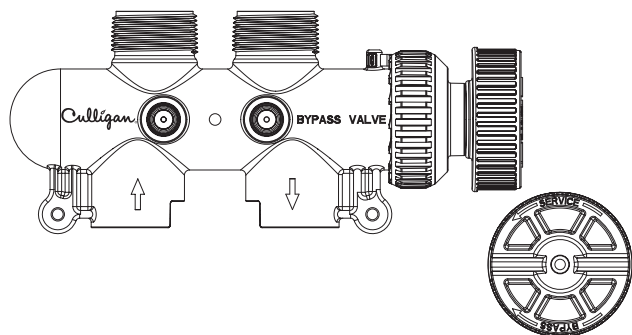


Figure 20. Turn blue bypass knob clockwise.

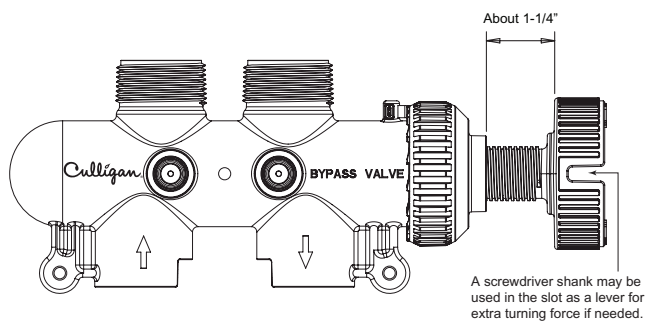


Figure 21. Turn bypass knob counter-clockwise.

Drain Line Connection

Refer to Table 6 for drain line length and height limitations under the applicable tank size.

1. Remove 1/2" pipe clamp from the small parts pack included with the control.
2. Route a length of 1/2" drain line from the drain elbow to the drain.
3. Fasten the drain line to the elbow with the clamp.
4. Secure the drain line to prevent its movement during regeneration. When discharging into a sink, or open floor drain, a loop in the end of the tube will keep it filled with water and will reduce splashing at the beginning of each regeneration.

NOTE Waste connections or drain outlets shall be designed and constructed to provide for connection to the sanitary waste system through an air gap of four pipe diameters or 1 inch, whichever is larger.

NOTE Note: Observe all plumbing codes. Most codes require an anti-siphon device or air gap at the discharge point. The system and installation must comply with state and local laws and regulations.

Operating Pressure	0 ft (0 m)	2 ft (0.6 m)	4 ft (1.2 m)	6 ft (1.8 m)	8 ft (2.4 m)	10 ft (3 m)
30 psi (210 kPa)	60 ft (18 m)	50 ft (15 m)	30 ft (9 m)	15 ft (5 m)	Not allowable	Not allowable
40 psi (279 kPa)	100 ft (30 m)	90 ft (27 m)	70 ft (21 m)	50 ft (15 m)	30 ft (9 m)	12 ft (4 m)
50 psi (349 kPa)	145 ft (41 m)	115 ft (35 m)	80 ft (24 m)	80 ft (24 m)	60 ft (18 m)	40 ft (12 m)
60 psi (419 kPa)			100 ft (30 m)	100 ft (30 m)	85 ft (26 m)	60 ft (18 m)
80 psi (559 kPa)	Normal installation should not require				140 ft (43 m)	120 ft (37 m)
100 psi (699 kPa)	more than 100 ft (30 m) of drain line					150 ft (46 m)

Table 6. Height of discharge above floor level operating.

Brine Line Connection

Models using a common brine tank should be assembled as follows:

1. Cut off approximately two inches of brine tubing, then attach the tubing to the brine safety valve. See Figure 22.
2. Connect the center leg of the duplex tee (provided in the small parts pack) to the other end of the tubing.
3. Connect the brine line tubing from each softener to the two remaining ends of the duplex tee. The nut and insert are provided in the small parts pack.

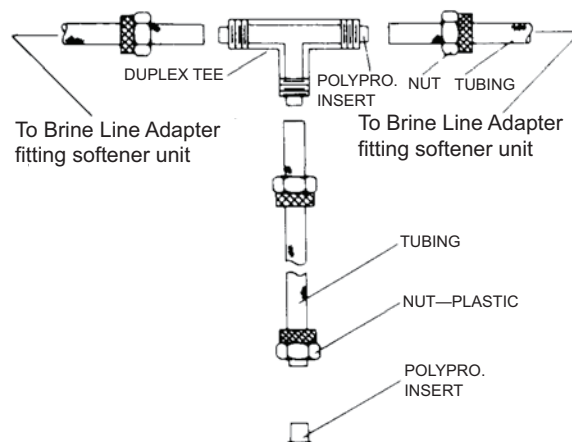


Figure 22. Brine system assembly.

Fill The Salt Storage Container

Fill the salt storage container with water until the level reaches about one (1) inch above the salt support plate. Pour salt into the container. Fill with salt to within a few inches of the top.

Brine System Installation

NOTE The brine system is purchased as an optional item to allow the use of various brine tank sizes to better suit the needs of the user.

The softener system is normally regenerated using a timed brine refill, dry or wet salt storage brine system. To properly install the brine system, set the brine tank assembly in a convenient location for ease of service and refill of salt into the brine tank.

Brine Piping

The softeners can be used with a variety of brine systems. Please refer to “High Efficiency 1.5 Twin Brinemaker Data—1/2” Valves” on page 130 for sizing parameters. Position the salt storage tank in a convenient location on a smooth surface. The brine valve should be at the rear to simplify removal of the tank cover.

1/2" Brine System

If you are connecting the valve to a 1/2" brine system (Figure 23), follow these instructions:

1. Connect 1/2" tubing (not supplied) between the brine valve in the salt storage tank and the brine fitting on the side of the valve.
2. If multiple softeners will be drawing brine from the same tank, connect the brine tubing from the brine fitting on each valve to a union tee (00401574, supplied with the small parts pack).

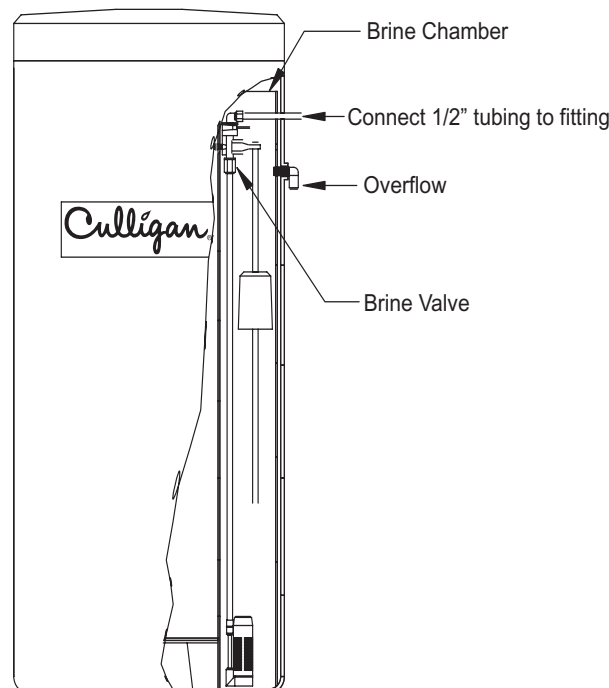


Figure 23. 1/2" Brine system.

Circuit Board Connections

The 24V power supply and flow meter wire harness is already connected to the circuit board. If no other circuit board connections are required proceed to the First Time Setup. Refer to the instructions below and Figure 26Figure 24 to Figure 41 for connecting accessories, including the Aqua-Sensor probe wire harness, to the circuit board.



WARNING! Disconnect all electrical power to the unit before connecting.



CAUTION! Grip all connections to the circuit board by the connecting terminals for assembly and disassembly. Failure to do so could result in damage to the wire leads or connecting terminals.



CAUTION! Do not touch any surfaces of the circuit board. Electrical static discharges might cause damage to the board. Handle the circuit board by holding only the edges of the circuit board. Mishandling of the circuit board will void the warranty.

NOTE Observe all state and local electrical codes.

1. Remove the electrical enclosure from the control valve. First remove the electrical enclosure screw and then gently remove the enclosure from the control. Refer to Figure 24 and Figure 25 and the following instructions.

NOTE The compartment plate is tightly connected to the enclosure and might be removed at the same time as the enclosure.

2. Remove the compartment plate from the enclosure, placing the plate against the frame.
3. Disconnect the 24V power supply wire harness from the circuit board. See Figure 24.
4. Grip the circuit board from the edges and gently rotate it to the back of the enclosure (you are disengaging the circuit board from the two support pins on the bottom and top of the enclosure). See Figure 25.
5. Remove the circuit board from the enclosure.

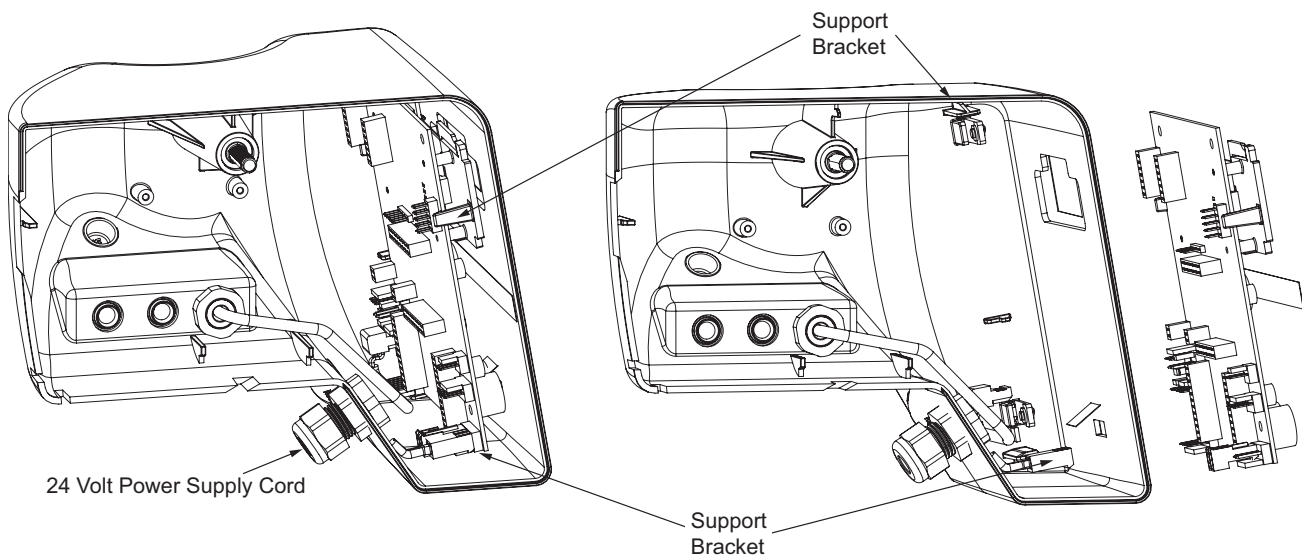


Figure 24. Circuit board power supply.

Figure 25. Circuit board removal.

To install HE 1.5 Twin accessory connections:

1. Remove the plastic nut from the meter strain relief fitting from HE 1.5 Twin Controller #1.
2. Disconnect the wire harness from the circuit board of HE 1.5 Twin Controller #1 and remove the harness.

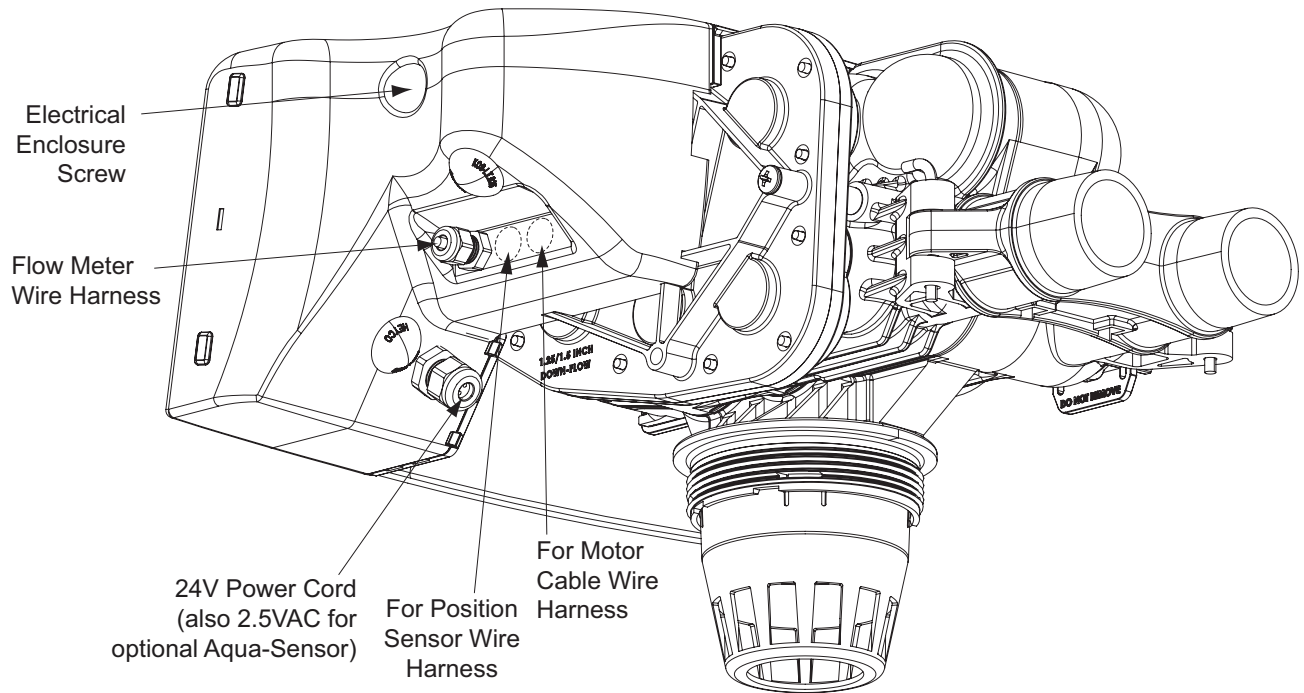


Figure 26. HE 1.5 Twin, main controller #1, electrical and accessory connections.

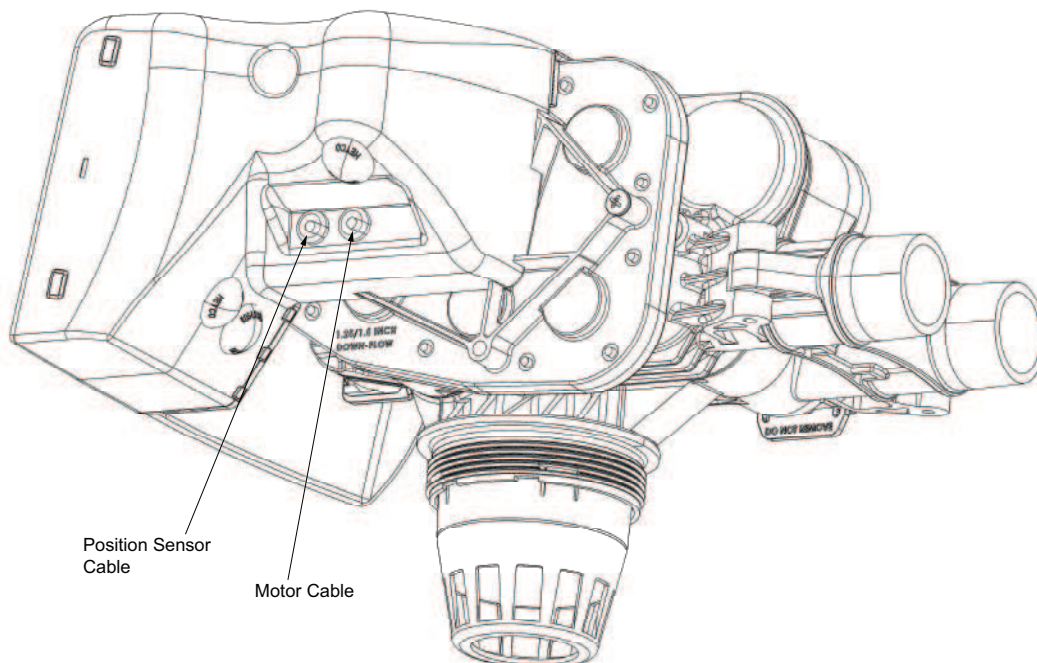


Figure 27. HE 1.5 Twin, controller #2, electrical and accessory connections.

3. Connect the auxiliary board to the main board. See Figure 26. The auxiliary board is shipped inside the carton for HE 1.5 Twin Controller #2.
4. Open the two ports through the molded recessed area (area #4). See Figure 26. Use a sharp object (screwdriver or knife) to push through the plastic.
5. Connect the motor cable, optical sensor cable, and meter cable from the HE 1.5 Twin Controller #2 to the auxiliary board (see Figure 28).
 - a. Remove the plastic nut from the strain relief fitting.
 - b. Place the harness and fitting through the port.
 - c. Tighten the nut on the interior of the enclosure.
 - d. Attach the connector to the appropriate location on the HE circuit board. See Figure 68.

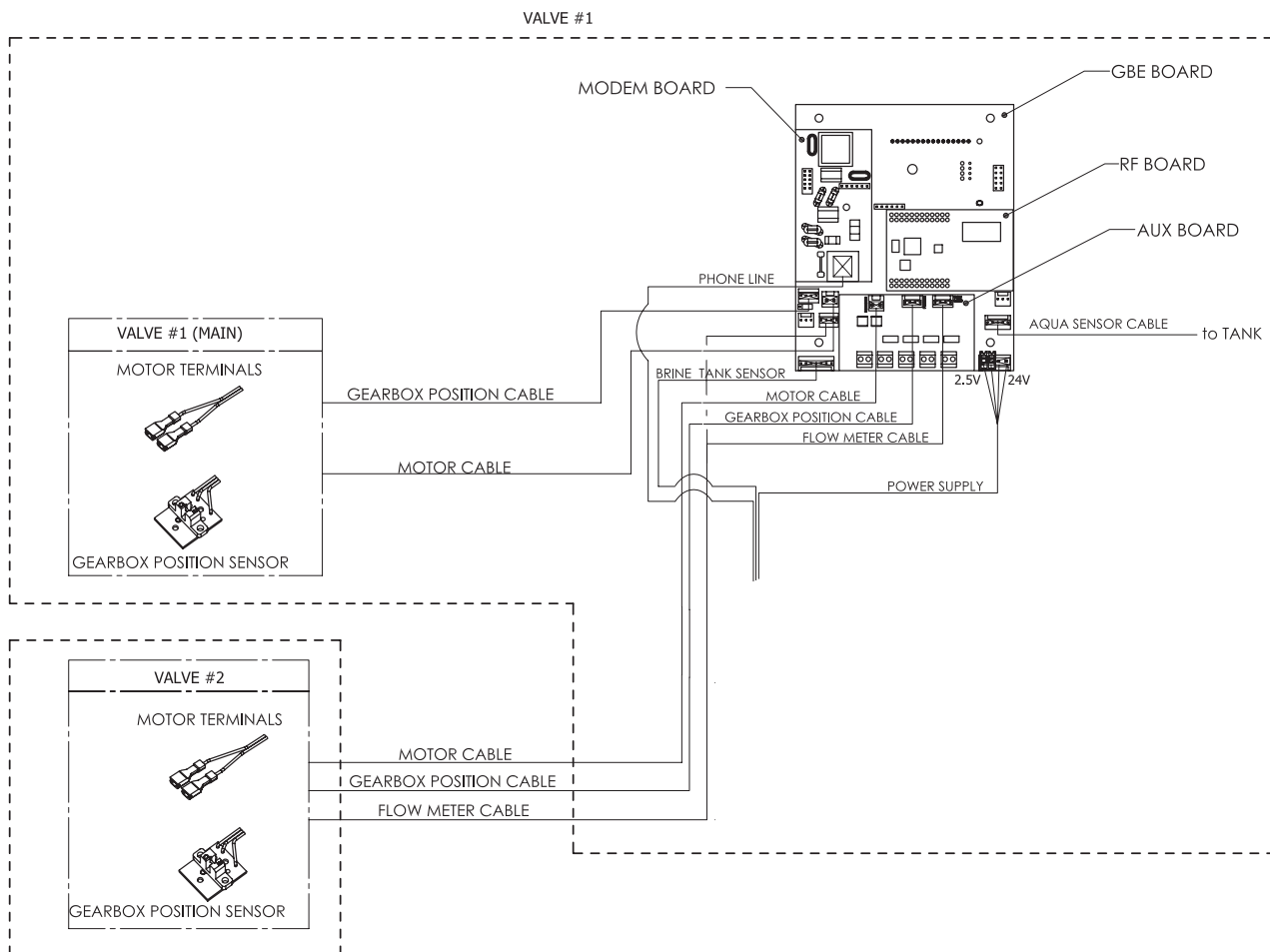


Figure 28. Circuit board connections.

Installing Accessory Connections

The HE 1.5 Controller enclosure has several portals to allow connections to HE accessories. Each connection portal is molded into the controller enclosure. If the portal is not already opened and/or plugged, it may be opened by pushing a sharp object (screwdriver or knife) through the plastic. See Figure 29.

A connector/bushing and/or plug should be placed in the port assigned for each HE 1.5 accessory. See Figure 29 and Figure 30 and Table 7 for connector/bushing and plug types and their position on the HE 1.5 Controller enclosure.

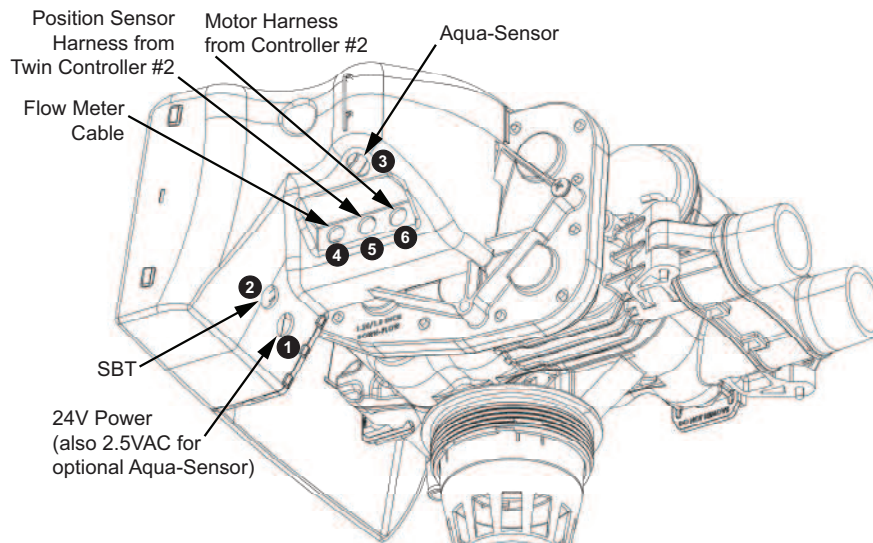


Figure 29. HE 1.5 Twin #1 Controller connection ports.



Figure 30. Connectors.

Part No.	Description	Location(s)	Connection
01025274	Strain Relief Fitting	1	24V Power (pre-installed)
01025264	Strain Relief Fitting	1, 2, 3	Aqua-Sensor, SBT, replaces 01025274 when used with optional 2.5VAC Power
01025277	Liquid Tight Hole Plug	1, 2, 3,	—
01025278	Bushing, strain relief	4, 5	HE 1.5 Twin #2 Position Sensor, Harness, HE 1.5 Twin #2 Motor Harness
—	Cord Grip, Liquid Tight	4, 5, 6	Flow Meter Harness

Table 7. Accessory connectors and possible connections.

To install an HE 1.5 accessory connection:

1. Remove the plastic plug from the port on the enclosure, or open the port through the molded recessed area.
2. Remove the plastic nut from the bushing attached to the preinstalled connector cable.
3. Place the bushing with the cable through the port.
4. Tighten the nut on the interior side of the port opening on the controller enclosure. See Figure 31.
5. Attach the female connector to the Smart Controller circuit board at the appropriate location.

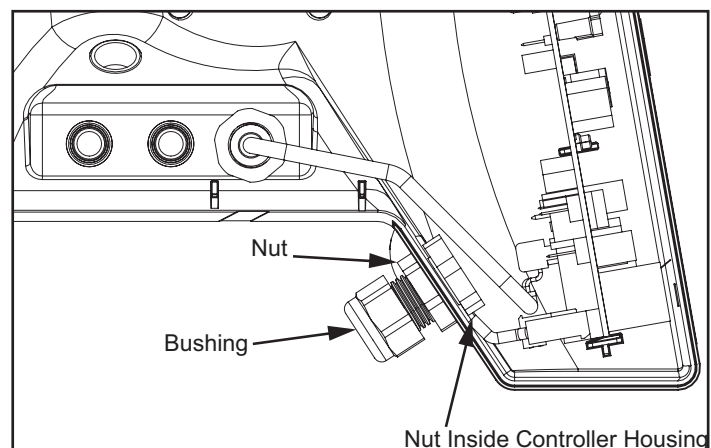


Figure 31. Connector bushing and nut position.

Installing Aqua-Sensor

1. Locate the Aqua-Sensor 2.5VAC power cord and bushing (01025264) packed in the small parts pack. The power cord has two spade terminals on one end of the cable and a plastic female connector on the other end.
2. Disconnect power from the circuit board.
3. Remove the power cord bushing (P/N 01025274) from the outdoor enclosure (location #1 in Figure 29) by loosening the nut from the 24V power cord bushing.
4. Discard the dummy connector on the 2.5VAC circuit board pins.
5. Remove the bushing cable assembly from the enclosure.
6. Press a small screwdriver into the slots on the plastic female connector housing to remove the two metal slip-in tabs on the 24V power cord. See Figure 32.
7. Remove the 01025274 bushing from the 24V power cord.
8. Insert the 24V and 2.5VAC power cords through the shared bushing (P/N 01025264). See Figure 33.
9. Use a small screwdriver to raise the tongue on each metal tab so it is protruding at the top. Reinstall the tabs in the housing. Tug lightly on the cord to make sure the tab does not pull free from the housing. See Figure 32.

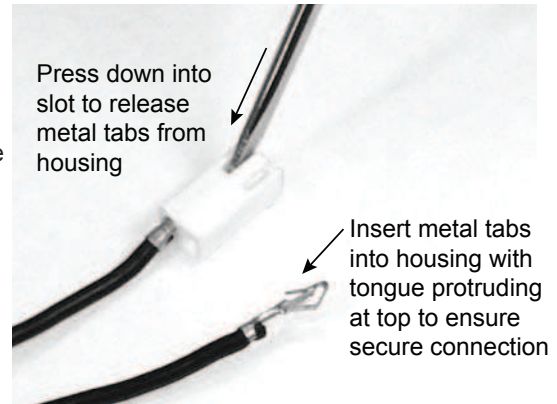


Figure 32.

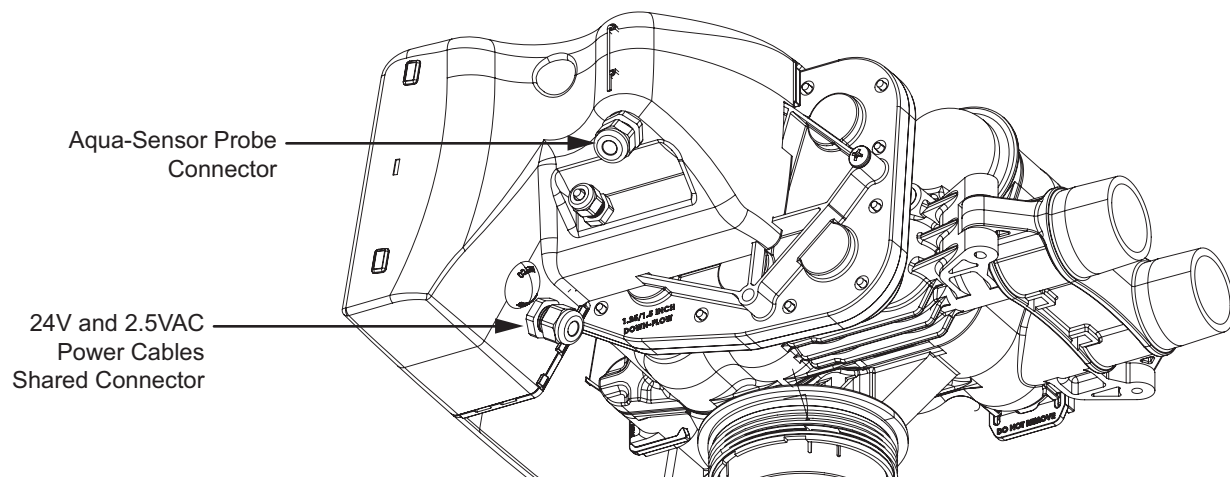


Figure 33. 24V Power and Aqua-Sensor connections on the controller.

10. Reinstall the terminal plugs on the 24V plastic connector.
11. Place the bushing with the cable through the opening and tighten the nut that is on the interior of the enclosure.
12. Plug each power connector to the appropriate pin on the Smart Controller circuit board. See Figure 34.



CAUTION! Verify wiring from the terminals to circuit board are correct before applying power to the control. 24V power must not be applied to the 2.5 VAC terminals.



CAUTION! Connecting 24V to the 2.5 VAC connection on the circuit board will damage the circuit board.

Reattaching Electrical Enclosure Cover to Control Valve

1. Align the circuit board in the enclosure with the three support brackets on the control valve frame. See Figure 35.
2. Align the compartment plate over the gear motor onto the control valve frame. Ensure that the gaskets on the compartment plate are positioned correctly to prevent leaks.
3. Pull the position sensor cable back through the gray rubber bushing.
4. Place the enclosure onto the control valve, aligning the circuit board edge with the slots on the control valve frame and the screw on the enclosure with the hole on the cover.

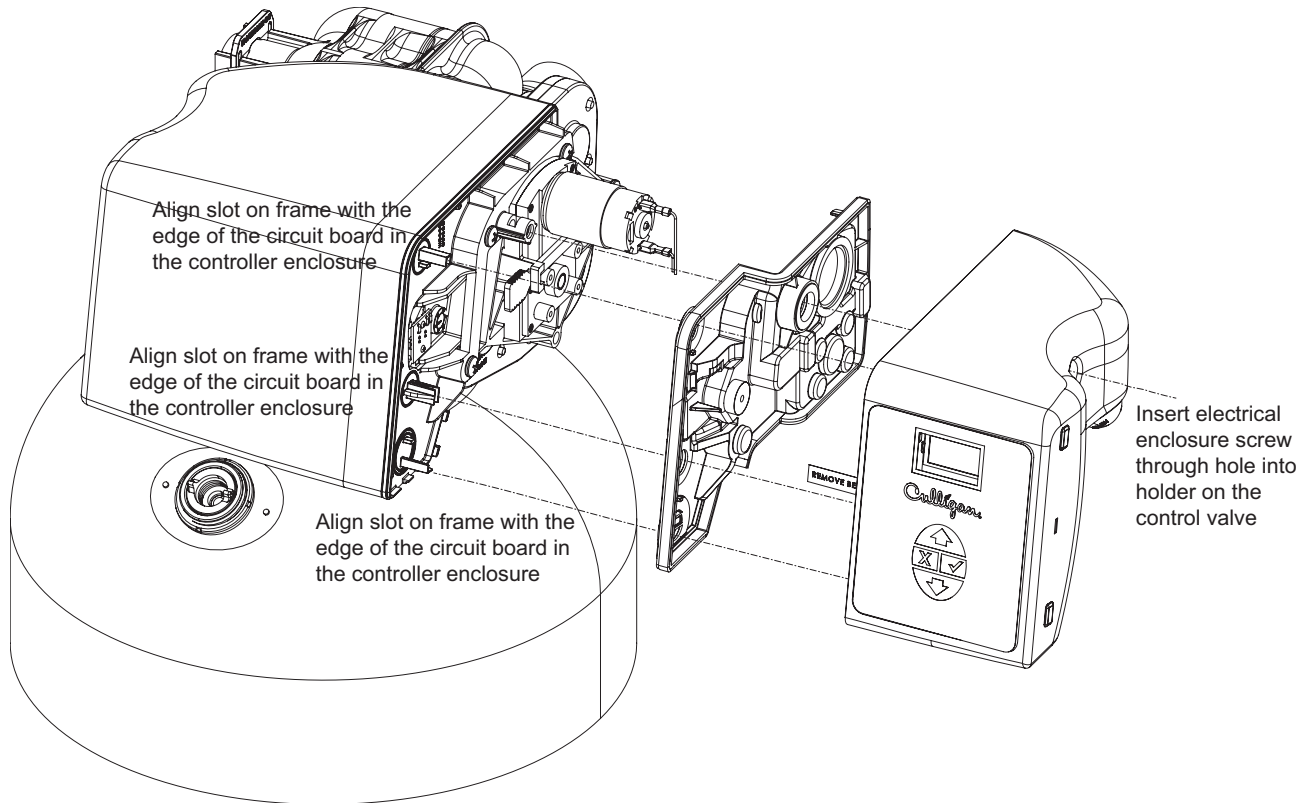


Figure 35. Attaching enclosure cover to control valve.

5. Screw the enclosure on the control.
6. Connect the 24V power cord to the two 24V terminals on the transformer.

Smart Controller Circuit Board Layout

Smart Controller Circuit Board Layout–Front

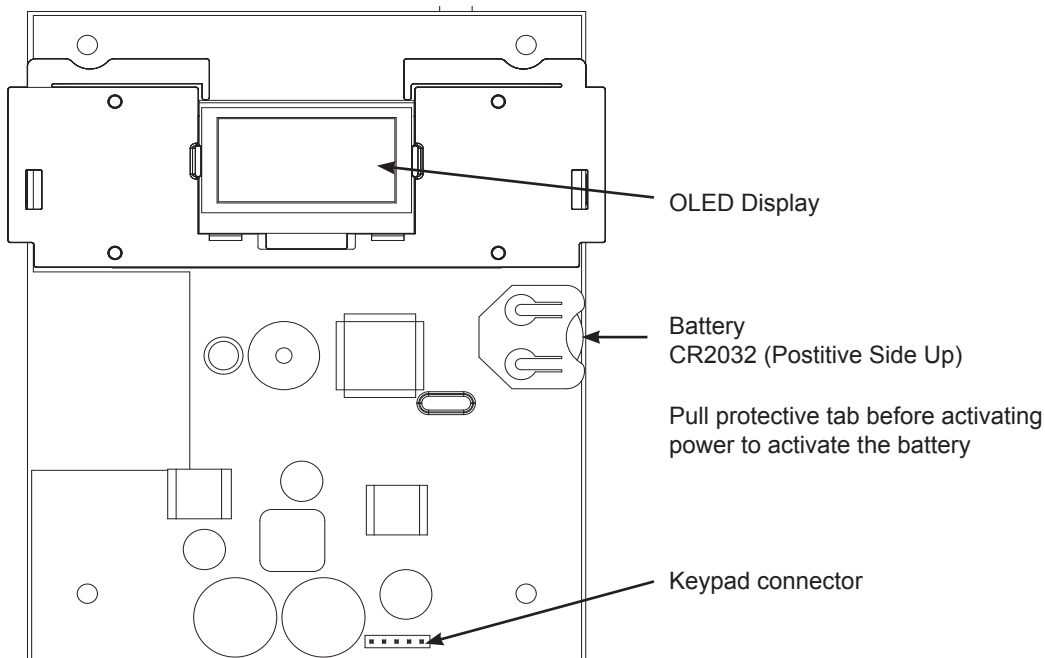


Figure 36. Smart Controller circuit board layout, front view.

Smart Controller Circuit Board Layout–Back

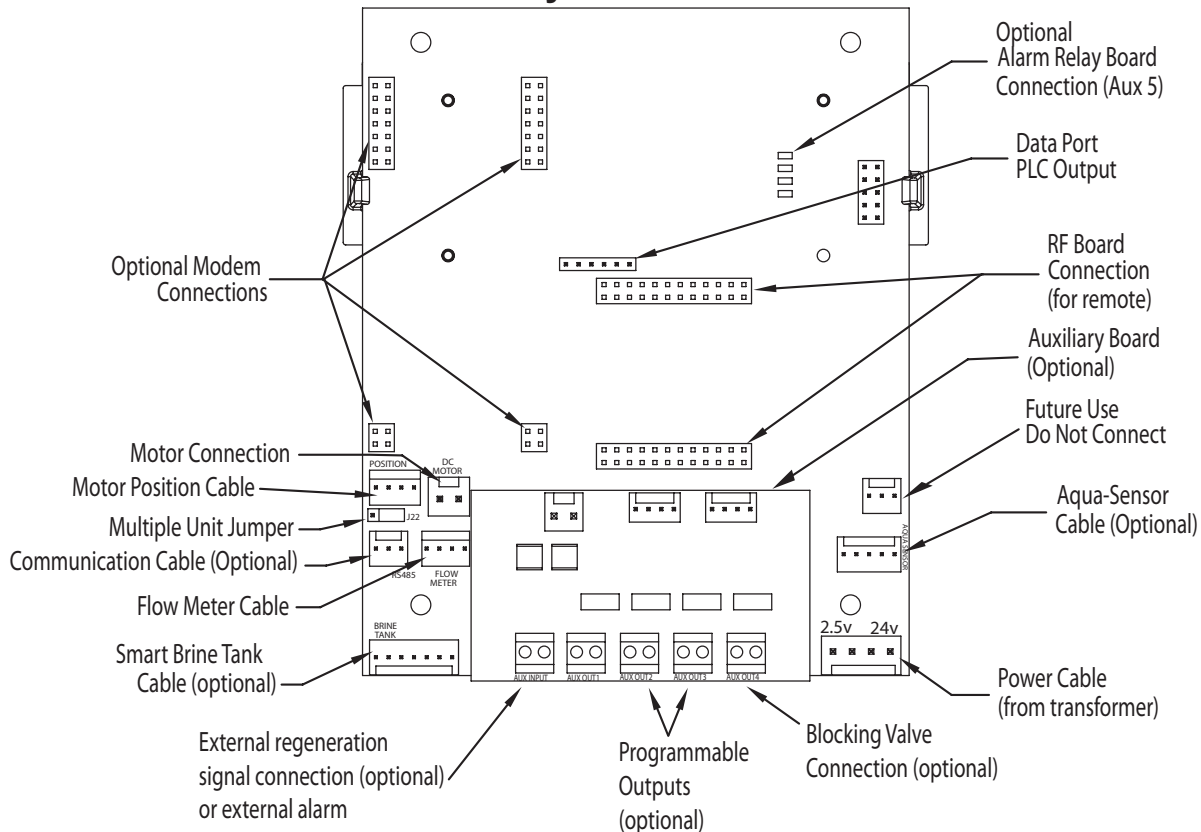
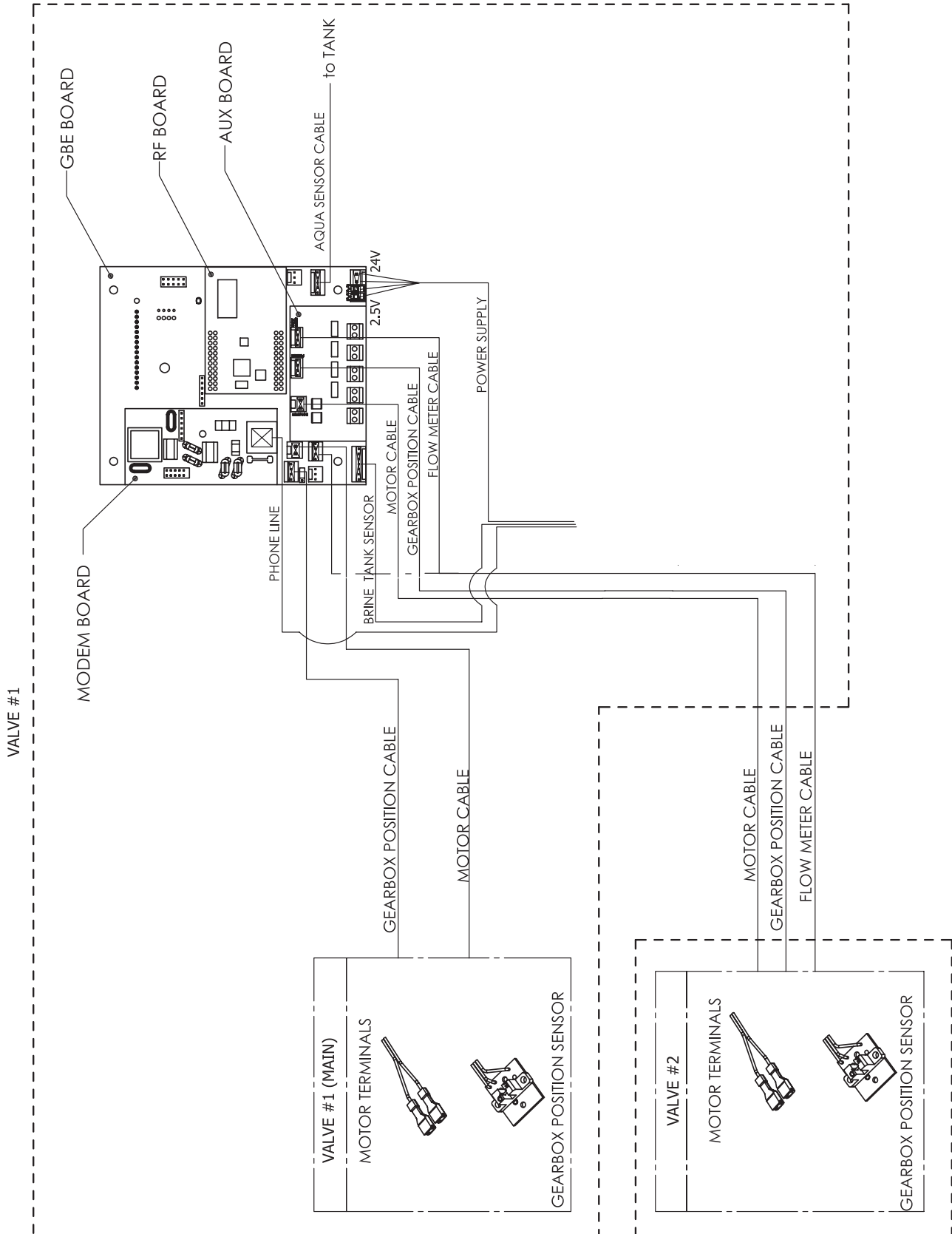


Figure 37. Smart Controller circuit board layout, rear view.

Electrical Schematic



Smart Controller Programming

Programming

The programming process requires various types of data input. The following information pertains to calculating the softening capacity of the water softening system.

Capacity Settings

The capacity of a water softener is determined by two factors; resin amount and water chemistry.

Single Tank Systems

Normally a single tank system has enough resin capacity to soften water for a minimum period of 24 hours. Time of regeneration is usually set to occur very early in the morning or at a time when no softened water is required. This is because when the softener is regenerating, hard water is typically bypassed through the system and into the facility if a demand for water is present.

If regeneration is desired at a time of day when there is no water usage then the system must have a “reserve” capacity which must last an entire day if the regeneration signal (time clock, Aqua-Sensor® and/or meter) occurs at the beginning of the day. Subtract this reserve capacity from the total capacity to determine capacity to signal.

Multiple Tank Systems

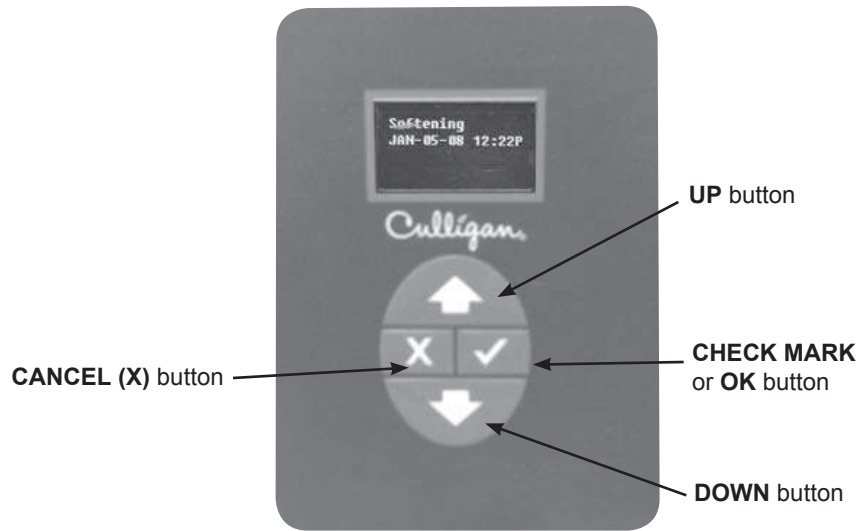
Multiple tank systems offer the benefit of continuous soft water supply. When using the Aqua-Sensor® to initiate a regeneration sequence, the system capacity may be set for the maximum amount the system is capable of producing. However multiple tank systems using only water meters and or time clock as the basis for regeneration initiation are recommended to be set up with a 30% reserve capacity. The purpose of the reserve capacity in multiple tank systems is to allow for subtle changes in water chemistry. You will be able to set the reserve capacity during programming.

Program Data Input

There are a few items to note that can make the programming of the Smart Controller a little easier. They are:

Slew Rates	This term refers to the speed at which the display moves through the input of material. For example, holding down the up arrow key for five (5) seconds when inputting minutes for Time of Day will cause the minutes to pass in ten (10) minute blocks of time. Press the up arrow or down arrow keys for shorter periods (less than 5 seconds) will slow the rate. To move through the programming slowly, do not hold down the up arrow or the down arrow keys.
Beeper	A beeper is available to assist the user by providing an audible tone (about 70 decibels) to signify valid (one beep) and invalid (three beeps) key presses. The beeper can be deactivated in the programming mode. (If error occurs, beep will still be ON even if set to “No” programming.)
Programming Mode Timeout	If there is no keypad activity for a three (3) minute period while in the programming mode, the controller will exit the programming mode and return to the main display. Any setting that was changed prior to the control timing out will revert back the original value. Pressing the check mark key saves the setting.
Program Input Acceptance	For programming information to be accepted, the check mark key must be depressed prior to programming mode timeout.

Navigating the Menus and Keypad




UP ARROW  button: scrolls up the menu




DOWN ARROW  button: scrolls down the menu



CHECK MARK  button: selects the highlighted option, opens a new screen, or accepts a changed setting



CANCEL or EXIT  button: returns to the previous screen or cancels a changed setting

NOTE Hold down the  or  button to quickly scroll through the setting without repeatedly pressing the button.














Basic Menu Operation

SOFTENING
JAN-01-12 12:01P

N/A

>1) INFORMATION
2) MANUAL MODE
3) SET DATE/TIME
4) ACCESSORIES

4. This is the main menu. The cursor/pointer (>) shows where you are in the menu.

<div>1) INFORMATION</div> <div>2) MANUAL MODE</div> <div>>3) SET DATE/TIME</div> <div>4) ACCESSORIES</div>	<div>5. Use  or  to scroll through the menu. The selection cursor scrolls down to the next line or displays the next screen.</div> <div>6. Press  to select the item next to the cursor.</div>
<div>SET</div> <div>MONTH JAN</div>	<div>7. The controller screen displays a setting title and value. Here we see the current value for the month setting is January.</div>
<div>SET</div> <div>MONTH >JAN</div>	<div>8. Press  to select the item. The screen displays a cursor next to the value. This indicates that the value may be changed by pressing the  or  button.</div>
<div>SET</div> <div>MONTH >FEB</div>	<div>9. Press  to select a new value. The screen displays the new setting value next to the cursor.</div> <div>10. Press  to select the next available value. You may press  or  to scroll through all available options for this setting.</div>
<div>SET</div> <div>MONTH FEB</div>	<div>11. Press  to accept the selected screen value. The screen displays the value, no longer preceded by the cursor.</div>
<div>SET</div> <div>DAY 1</div>	<div>12. Press  to scroll to the next setting.</div>
<div>1) INFORMATION</div> <div>2) MANUAL MODE</div> <div>>3) SET DATE/TIME</div> <div>4) ACCESSORIES</div>	<div>13. Press  to exit from the setting without saving changes. The screen displays the parent menu (such as the main menu).</div>
<div>SOFTENING</div> <div>JAN-01-12 12:01P</div>	<div>N/A</div>

NOTE Unplugging the Culligan HE 1.5 Twin water softener will not affect any of the control settings (the control must be plugged in for at least 15 minutes). Once programmed, the settings will be stored indefinitely.

Smart Controller Programming

The programming for the Smart Controller is based on a menu structure. There are six top-level menus with additional options in submenus. The top-level menus are:

1. INFORMATION
2. MANUAL MODE
3. SET DATE/TIME
4. ACCESSORIES
5. ADV. SETUP
6. DIAGNOSTICS

Here is a brief explanation of what you will find under each menu.

Menu/Submenu	Description
Information	Scrolls through the operating information for the unit.
Manual Mode	Initiates a manual regeneration.
Set Time and Date	Sets or changes the time and/or date. This is initially done during first time set up. This information is saved in memory even in the event of a power outage.
Accessories	Sets up any installed accessories. This includes Aqua-Sensor®, beeper, Aux In, Aux Outputs, Smart Brine Tank sensor, Wireless Remote, Modem, Chlorinator, flow meter, service phone line, and external filter.
Advanced Setup	Customizes the unit settings. There are five sub-menus that offer customized settings.
System Setup	Customizes many of the initial setup information. Water Hardness, Iron, Salt Type, Resin Type and Line Pressure are among the settings.
Regeneration Setup	Specifies custom salt dosage, reserve capacity, regeneration time and regeneration mode.
Cycle Times	Specifies custom cycle times for the units.
Regeneration Trigger	Specifies custom regeneration triggers, the regeneration interval, predict mode and days of regeneration.
Diagnostics	Performs diagnostics for sensors, wireless, progressive flow, motor control, data port, phone line (modem), and displays advanced statistics.

Typical Commercial Setup

Setting up the Smart Controller for a commercial installation requires a few additional steps. Follow the outline below to make sure everything is covered.

1. Run the first time setup (see following page).
2. Set up accessories. These include:
 - Aqua-Sensor®
 - Beeper
 - Aux In
 - Aux Outs (needed for multi-tank, brine reclaim and refill on 4-cycle valves)
 - Smart Brine Tank Sensor
 - Wireless Remote
 - Modem
 - Alarm Relay
 - Service Phone
 - External Filter
3. You must configure the controller differently for a multi-tank system. This is explained in the Customizing Setup section.
4. If you are using immediate regeneration, you must change the Reserve Capacity setting under Advanced Setup/ REGEN SETUP and the REGEN MODE.
5. Set/Review Cycle Times—this is under Advanced Setup/Cycle Times. The Brine Draw/Rinse and Refill/Fast Rinse times are now set during First Time Setup. You only need to adjust the settings if required by the application.
6. The Smart Controller has an update feature that will transfer the master programming to all other units in the system. One trick that will make this easier is to program the units in reverse. Then when programming the Master last, you can run the Update menu item immediately.
7. Refer to “Quick Reference” on page 131 for quick programming charts.

Pre-Programming Information Checklist

Before programming please have the following information available:

- Unit's cubic feet of resin
- your intended salt dosage
- water hardness
- dealership service phone number

Depending on the accessories installed, you might also need the following:

- K-factor (for meter)
- trip flow (for multi-tank progressive flow)
- brine tank size (for smart brine sensor)
- local telemetry data phone number (for modem)
- your dealer account number (used with modem for setting up telemetry)

First Time Setup

First Time Setup Procedure

When a new controller is first powered on, the screen will display the first time setup message. The Smart Controller is designed to simplify the setup and installation process by making some default recommendations during the initial setup. These default settings are designed to be appropriate for most common installations.

Default Settings



















- Downflow Brining²
- Time of Regen = 2:00 AM²
- Regen Time = Delayed²
- Predict Mode OFF³
- 30% Reserve Capacity²
- Regen Interval Days = OFF³
- Day-of-week Regen = OFF³
- Pre-Rinse Mode = OFF¹

1= these items are changed on the Main Menu / Advanced / System Setup Menu


2= these items are changed on the Main Menu / Advanced / Regen Setup Menu

3= these items are changed on the Main Menu / Advanced / Regen Trigger Menu

If at any time you need to re-run the First Time Setup, refer to the Menu Information section. After completing the plumbing connections to the water softener, turn on and program the Smart Controller.





Screen Display	Range	Procedure
FIRST TIME SETUP PRESS DOWN ARROW	N/A	1. When a new controller is first turned on, the screen displays FIRST TIME SETUP . Press  to view and change (if necessary) the softener configuration.
S/N: 00025526 FWR217LT01 Jul 24 2012	N/A	2. The screen displays the serial number and firmware version for the HE 1.5 Controller. Press  to view the next setting. NOTE If this unit will be installed with a modem, it is required that this electronic ID number be reported to Culligan on the Web site myculligan.com .
SET MONTH JAN	JAN-DEC	3. The screen displays the first date setting for the controller. 4. Press   or  and then  to change the month setting from the default value.
SET DAY 1	1-31	5. The screen displays the default day setting. Press   or  and then  to change the value.
SET YEAR 2012	2009-2030	6. The screen displays the default year setting. Press   or  and then  to change the value.
CLOCK TYPE 12 HR	12 HR or 24 HR	7. The screen displays the clock type setting. Press   or  and then  to change the value.

Screen Display	Range	Procedure
SET HOUR 12PM	12AM–11PM 0–23	8. The screen displays the hour setting. Press or and then to change the value.
SET MINUTES 1	0–59	9. The screen displays the minutes setting. Press or and then to change the value.
UNIT TYPE SOFTENER	Softener, Filter, or Resin+Carbon	10. The screen displays the unit type setting. Keep this setting at the default, SOFTENER . Press to view the next setting.
VALVE TYPE HE 1.5 Twin	HE 1, HE 1.25, HE 1.5, HE 1 Twin, HE 1.5 Twin, 4-Cycle, 5-Cycle, or Plat Plus	11. The screen displays the valve type setting. Press or and then to change the setting to HE 1.5 Twin .
UNITS US INCH	U.S. Inch, Metric	12. The screen displays the units of measure setting. Press or and then to change the setting.
INSTALL TYPE Commercial	Residential, Commercial	13. The screen displays the installation type setting. Press or and then to change the setting to Commercial .
TOTAL CAPACITY 1000 GALLONS	10–999,999	14. The screen displays the total capacity of the unit, in gallons. Press and then to change this setting.
BRINING TYPE Downflow	Downflow, Upflow, Proportional	15. The screen displays the brining type setting. Press and then to change this setting from the default, Down-flow . Press to leave the setting unchanged and view the next setting, BRINE DRAW-RINSE .
BRINE DRAW-RINSE 60 MINUTES	0–150	16. The screen displays the brine draw-rinse setting. For residential softener applications this value should be 60 minutes. Press or and then to extend the time if the brine is not properly rinsing out within this duration.



Screen Display	Range	Procedure
FILL TIME 10 MINUTES	0–150	17. The screen displays the fill time setting based on the salt dosage. Press  to leave the setting unchanged. NOTE See “High Efficiency 1.5 Twin Refill Minutes/Salt Dosage/Capacity” on page 129 for refill times.
Initializing JAN-01-12 12:01P	N/A	18. The setup is complete; the circuit board microprocessor calculates softener capacity and “homes” the control valve.
SOFTENING JAN-01-12 12:01P		19. The screen displays the current state (the display alternates between Softening and the next programmed regeneration) and the date/time set for the unit. This is the home screen.

Menu Default

Use this procedure to default the board to factory settings and begin the first time setup.

1. Power down the control.
2. Power up the control while continuing to hold  and  for at least ten (10) seconds.
3. Release  and . The display should be blank; if it is not, go back to step 1.
4. The controller then restarts, lights up the display screen, and then displays **FIRST TIME SETUP**.
5. Follow the **FIRST TIME SETUP** process.

Menu Lockout

It is possible to lock the keypad of the controller so that users will only have access to the **INFORMATION**, **MANUAL MODE**, and **SET DATE/TIME** menu screens. The system can be locked from the home screen by pressing  and  simultaneously and holding them down for 10 seconds. Repeating this process will unlock the keypad.

Customizing Set Up

There may be times when the installer would prefer to override the default regeneration selections. See Advanced Setup Menu, Regeneration Setup Menu or Regeneration Trigger Menu for information on changing default selections.

Advanced Setup Menu

















The following settings can be changed or customized using the Advanced System Setup menu:

- Valve Type
- Units
- Pre-Rinse Mode
- Multi-tank System

NOTE The control must be returned to the HOME screen if settings are changed.

System Setup

NOTE Default values are shown for each setting.

Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
2)MANUAL MODE 3)SET DATE/TIME 4)ACCESSORIES >5)ADV. SETUP	1-6	2. The screen displays the main menu. Press      to select 5)ADV. SETUP .
>1)SYSTEM SETUP 2)REGEN SETUP 3)CYCLE TIMES 4)REGENTRIGGER	1-4	3. The screen displays the advanced setup menu. The menu includes SYSTEM SETUP , REGEN SETUP , CYCLE TIMES , and REGENTRIGGER . 4. Press  to select 1)SYSTEM SETUP .
VALVE TYPE HE 1.5 Twin	N/A (displays HE 1.5 Twin)	5. The screen displays the valve type setting specified during the first-time setup. This setting cannot be changed. Press  to view the next setting.
UNITS US INCH	U.S. Inch, Metric	6. The screen displays the units of measure setting. Press   or  and then  to change the setting.
TWIN PRERINSE 5 MINUTES	0-5	7. The screen displays the HE 1.5 Twin prerinse mode setting, which specifies the the duration of rinsing the standby tank prior to going online. Press   or  and then  to change the value.

Screen Display	Range	Procedure
PRERINSE MODE OFF	Off, On	8. The screen displays the prerinse mode setting, which specifies the unit drain intervals and durations. Press or and then to change the value from OFF to ON .
RINSE IF NO FLOW FOR 24 HOURS	1–240	9. The screen displays the rinse interval. If prerinse mode is ON , the unit will drain if no flow is detected for the duration of this interval. Press or and to change the value.
RINSE FOR 5 MINUTES	1–15	10. The screen displays the rinse duration. If prerinse mode is ON , specify the number of minutes the unit should rinse to drain when the RINSE IF NO FLOW duration has passed. Press or and then to change the setting.
>1)SYSTEM SETUP 2)REGEN SETUP 3)CYCLE TIMES 4)REGEN TRIGGER		11. The customized setup is complete. The screen displays the advanced setup menu.
SOFTENING JAN-01-12 12:01P		12. Press to display the home screen.

Regeneration Setup

The following settings can be changed and/or customized using regeneration setup:

- Total Capacity
- Reserve Capacity
- Time of Regeneration
- Regeneration Mode
- Regeneration Lockout
- Power Up Regeneration

NOTE If any settings are changed the controller must be returned to the HOME screen.



Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press to view the main menu.
2)MANUAL MODE 3)SET DATE/TIME 4)ACCESSORIES >5)ADV. SETUP	1–6	2. The screen displays the main menu. Press to select 5)ADV. SETUP .

Screen Display	Range	Procedure
1)SYSTEM SETUP >2)REGEN SETUP 3)CYCLE TIMES 4)REGEN TRIGGER	1–4	3. The screen displays the advanced setup menu. Press to select 2)REGEN SETUP .
TOTAL CAPACITY 1000 GALLONS	10–999,999	4. The screen displays the total capacity of the unit, in gallons. Press and then to change this setting.
RESERVE CAPACITY 5% (50 GAL)	0–99	5. The screen displays the reserve capacity setting. This setting is generally used for a single-delay system. For a HE 1.5 Twin softener the typical setting is 5 percent reserve capacity. Press or and then to change the value.
BRINING TYPE Downflow	Downflow, Upflow, Proportional	6. The screen displays the brining type setting. See page 4 for an explanation of brining types. Press or and then to change the setting.
TIME OF REGEN 2:00AM	12:00AM– 11:59PM	7. The screen displays the regeneration scheduled time setting. Press or and then to change the setting.
REGEN MODE IMMEDIATE	Delayed, Immediate	8. The screen displays the regeneration mode setting. Press or and then to change the setting to IMMEDIATE . NOTE If DELAYED is selected then change the Reserve Capacity setting.
POWER UP REGEN 3 PLUS HOURS	No, 3 Plus Hours	9. The screen displays the regeneration power up setting. This setting specifies whether to initiate an immediate regeneration after a power outage longer than three hours. Press or and then to change the setting.
REGEN LOCKOUT FOR 0 HOURS	0–12	10. The screen displays the regeneration lockout setting. This setting prevents back-to-back regenerations on multi-tank systems. When one unit is done regenerating, the next regeneration cannot begin until the regen lockout time has passed. Press to keep the default setting at zero (0).
1)SYSTEM SETUP >2)REGEN SETUP 3)CYCLE TIMES 4)REGEN TRIGGER		11. The regeneration setup is complete. The screen displays the advanced setup menu.
SOFTENING JAN-01-12 12:01P		12. Press to display the home screen.























Cycle Times Setup




The following settings can be changed and/or customized using the cycle times setting:

- Backwash Time
- Brine Draw/Slow Rinse Time
- Fast Rinse Time

Use the same procedure to change the values of other cycle times setup settings. Press  to scroll through the settings, unless otherwise instructed. After changing the setting, press  to accept the displayed screen value. The Controller will display the next system setting from the menu.

NOTE If any settings are changed the controller must be returned to the HOME screen.



Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
2)MANUAL MODE 3)SET DATE/TIME 4)ACCESSORIES >5)ADV. SETUP	1-6	2. The screen displays the main menu. Press      to select 5)ADV. SETUP .
1)SYSTEM SETUP 2)REGEN SETUP >3)CYCLE TIMES 4)REGEN TRIGGER	1-4	3. The screen displays the advanced setup menu. Press    to select 3)CYCLE TIMES .
CYCLE TIMES USE DEFAULTS	Use Defaults, Custom	4. The screen displays the cycle times setting. If USE DE-FAULTS is selected, the program calculates the cycle times based on hardness and resin volume. Press   or  and then  to select CUSTOM to set the backwash, brine draw-rinse, fast rinse, and fill times.
BACKWASH TIME 10 MINUTES	0-150 minutes	5. The screen displays the backwash time setting. Press   or  and then  to change the value; however, in general you will not need to change this setting.
BRINE DRAW-RINSE 60 MINUTES	0-150 minutes	6. The screen displays the brine draw-rinse setting. For HE 1.5 commercial softener applications this value should be 61 minutes. Press   or  and then  to extend the time if the brine is not properly rinsing out within this duration.
FAST RINSE-TIME 10 MINUTES	0-150 minutes	7. The screen displays the fast rinse time setting. For HE 1.5 commercial softener applications this value should be set to 10 minutes. Press  to keep the default setting at 10.

Screen Display	Range	Procedure
FILL TIME 377 SECONDS	0–9000 seconds	8. The screen displays the fill time setting, based on the salt dosage. Press  to keep the calculated setting.
1)SYSTEM SETUP 2)REGEN SETUP >3)CYCLE TIMES 4)REGEN TRIGGER		9. The cycle times setup is complete. The screen displays the advanced setup menu.
SOFTENING JAN-01-12 12:01P		10. Press   to display the home screen.










Regeneration Triggers Setup

The following settings can be changed and/or customized using Regeneration Trigger:

- Flow Meter
- Aqua-Sensor®
- Regeneration Interval (Time Clock Backup)
- Predict Mode
- Day of Regeneration

Use the same procedure to change the values of other regeneration triggers setup settings. Press  to scroll through the settings, unless otherwise instructed. After changing the setting, press  to accept the displayed screen value. The Controller will display the next system setting from the menu.

NOTE If any settings are changed the controller must be returned to the HOME screen.

Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
2)MANUAL MODE 3)SET DATE/TIME 4)ACCESSORIES >5)ADV. SETUP	1–6	2. The screen displays the main menu. Press      to select 5)ADV. SETUP .
1)SYSTEM SETUP 2)REGEN SETUP 3)CYCLE TIMES >4)REGEN TRIGGER	1–4	3. The screen displays the advanced setup menu. Press    to select 4)REGEN TRIGGER .













Screen Display	Range	Procedure
FLOW METER CAN TRIGGER	Can Trigger, Cannot Trigger	<p>4. The screen displays the flow meter regeneration trigger setting; an optional flow meter may trigger the controller to initiate regeneration. If set to CAN TRIGGER, the flow meter counts the gallons of softened water until reaching the batch value, which triggers regeneration. A water meter may be used only to monitor flow rate and total usage but not to trigger regeneration. A system may also have both a water meter and Aqua-Sensor installed and able to trigger regeneration; either can trigger regeneration, and then the system is reset when regeneration is complete. Press or and then to change the value.</p> <p>NOTE See page 135 for further details about setting up a meter as a backup for an Aqua-Sensor.</p>
AQUASENSOR CAN TRIGGER	Can Trigger, Cannot Trigger	<p>5. The screen displays the Aqua-Sensor regeneration trigger setting, which allows an optional Aqua-Sensor to trigger the controller to initiate regeneration. A system may also have both a water meter and Aqua-Sensor installed and able to trigger regeneration; either can trigger regeneration, and then the system is reset when regeneration is complete. Press or and then to change the setting.</p>
REGEN INTERVAL NUMBER OF DAYS: 0	0–99	<p>6. The screen displays the regeneration interval, which sets up a time clock backup for the installed trigger device. Press or and then to change the setting.</p> <p>NOTE See page 6 for a more detailed explanation of the regeneration interval.</p>
PREDICT MODE OFF	On, Off	<p>7. The screen displays the predict mode, which is used in the flow meter to determine the optimum regeneration point. Prior to regeneration the control compares the remaining capacity with the average daily water usage. If the average daily water usage is less than remaining capacity, then the controller will delay regeneration 24 hours. Reduce the RESERVE CAPACITY setting when using predict mode. Press or and then to change the setting.</p>
REGENERATION ON MONDAY OFF	On, Off Monday –Sunday	<p>8. The screen displays the scheduled regeneration setting. Select ON for the displayed day to initiate regeneration on that day regardless of the meter or Aqua-Sensor. Press or and then to change the setting for each day.</p>
1)SYSTEM SETUP 2)REGEN SETUP 3)CYCLE TIMES >4)REGEN TRIGGER		<p>9. The regeneration triggers setup is complete. The screen displays the advanced setup menu.</p>
SOFTENING JAN-01-12 12:01P		<p>10. Press to display the home screen.</p>

Installing Accessories











The following HE 1.5 accessories, if installed, are set up using the **4) ACCESSORIES** menu.

1. Aqua-Sensor Probe (optional)
1. Setting the Beeper Mode
2. Auxiliary Input (not used for HE applications)
3. Auxiliary Outputs (not used for HE applications)
4. Smart Brine Tank Sensor (optional)
5. Wireless Remote (optional)
6. Modem (optional)
7. Chlorinator (not currently used for HE applications)
8. Flow Meter
9. Service Phone Number
10. External Filter

1) AQUASENSOR (Aqua-Sensor® Probe)

Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
1) INFORMATION 2) MANUAL MODE 3) SET DATE/TIME >4) ACCESSORIES	1-6	2. The screen displays the main menu. Press     to select 4)ACCESSORIES .
>1) AQUASENSOR 2) BEEPER 3) AUX IN 4) AUX OUTPUTS	1-12	3. The screen displays the accessories menu. Press  to select 1)AQUASENSOR .
AQUASENSOR NOT INSTALLED	Not Installed Installed	4. The screen displays the installation status of the wireless remote. Press    to change the state to installed. The Smart Controller can then communicate with Aqua-Sensor. <div>NOTE The Aqua-Sensor probe is installed during the final startup procedure. See page 73.</div>
AQUASENSOR DEBUG OFF	On, Off	5. The screen displays the Aqua-Sensor debugging tool status. Keep this setting at OFF ; the tool is accessible only at the factory. Press  to return to the accessories menu.
SOFTENING JAN-01-12 12:01P		6. Press   to display the home screen.

2) BEEPER (Setting the Beeper Mode)

Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
1) INFORMATION 2) MANUAL MODE 3) SET DATE/TIME >4) ACCESSORIES	1-6	2. The screen displays the main menu. Press     to select 4) ACCESSORIES.
1) AQUASENSOR >2) BEEPER 3) AUX IN 4) AUX OUTPUTS	1-12	3. The screen displays the accessories menu. Press  to select 2) BEEPER.
BEEPER MODE ALWAYS OFF	Always Off Always On 12 HR Warnings 24 HR Warnings	4. The screen displays the beeper mode settings. Press   or  and then  to change the setting. See Table 6.

Beeper Mode Display	Beeps When Key is Pressed	Alarm Beeps
ALWAYS ON	YES	NO
ALWAYS OFF	NO	NO
12 HOUR WARNINGS	YES	Between 8 AM-8 PM
24 HOUR WARNINGS	YES	Always

Table 8. Beeper mode settings.

SOFTENING JAN-01-12 12:01P

5. Press  to display the home screen.


















3) AUX IN (Installing Auxiliary Inputs)

One auxiliary input is provided for optional signal devices such as remote push buttons, differential pressure switches, hardness monitors, turbid meters, etc. for the purpose of receiving a regeneration signal. The Aux Input can also be configured as an external alarm trigger.

To provide a regeneration signal, select an UNPOWERED contact within the remote device that will close when regeneration is desired. The duration of the switch closure can be as low as 0 seconds; 6 seconds is the recommended minimum and default but can be as long as 999 seconds. The contact must automatically open following the start of a regeneration sequence. Connect this contact to the Aux In terminal.

To use as external alarm trigger, select an UNPOWERED contact within the remote device that will close when the alarm condition exists. The duration of the switch closure can be as low as 0 seconds; 6 seconds is the recommended minimum and default but can be as long as 999 seconds.

AUX Input Setup

Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
1) INFORMATION 2) MANUAL MODE 3) SET DATE/TIME >4) ACCESSORIES	1-6	2. The screen displays the main menu. Press     to select 4) ACCESSORIES.
1) AQUASENSOR 2) BEEPER >3) AUX IN 4) AUX OUTPUTS	1-12	3. The screen displays the accessories menu. Press     to select 3) AUX IN.
AUX INPUT 6 SECONDS	1-999	4. Press  to accept the default six (6)-second auxiliary input.
AUX INPUT REGEN TRIGGER	Regen Trigger, Ext. Alarm, Regen Inhibit	Press   or  and then  to change the setting from REGEN TRIGGER to EXTERNAL ALARM. When set to REGEN TRIGGER (default), the GBE will initiate regeneration when it receives a signal. When set to EXTERNAL ALARM, the GBE will enter an alarm condition when it receives a signal. The screen displays the error message AUX INPUT ALARM.
SOFTENING JAN-01-12 12:01P		5. Press    to save the settings and return to the home screen.

4) AUX OUTPUTS (Auxiliary Outputs)

The auxiliary board (Figure 38) comes installed in all commercial softeners and filters. It can control up to four 24 Volt outputs for various functions (max current 2.1 Amps output). The Auxiliary Outputs (see Figure 39) are output triacs that can be programmed to provide power to a normally open (normally no power to auxiliary output until power required) or a normally closed contact (user choice), and repeat cycle.

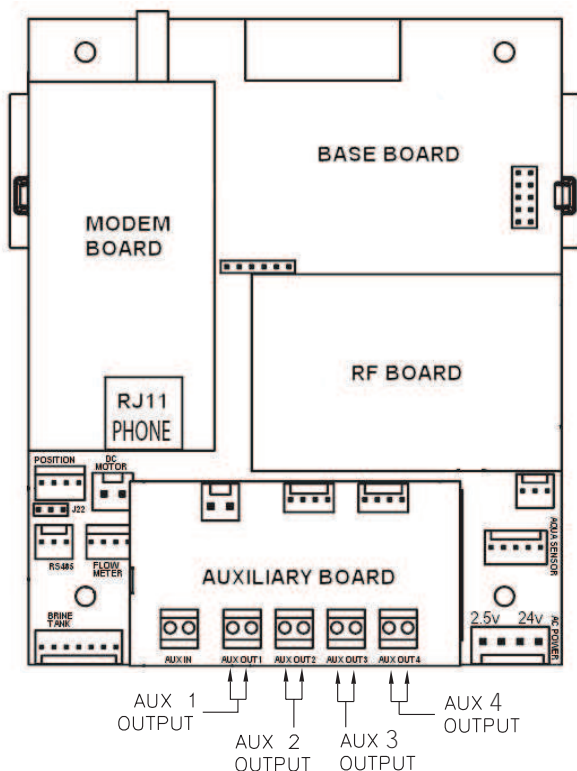


Figure 38. Auxiliary outputs.

For example, Figure 40 shows how the timing would work if an auxiliary output is set to NORMALLY OFF. The cycle position is set to BACKWASH, the delay minutes setting is greater than zero, and ON minutes is greater than zero.

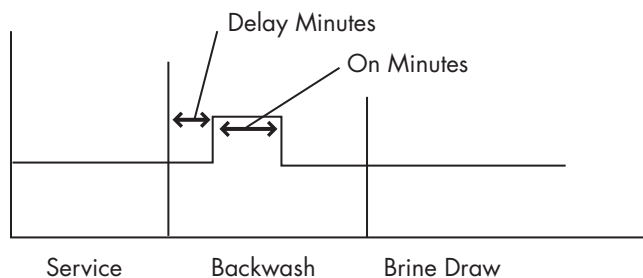


Figure 40. Auxiliary board activation timing.

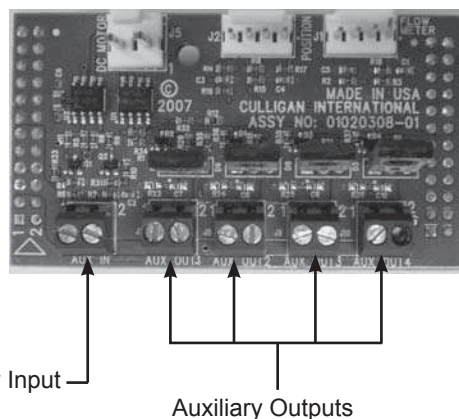
















Figure 39.


















Auxiliary board input and outputs.

AUX OUTPUTS Settings

Follow the same steps for setting up AUX OUT 1, AUX OUT 2, or AUX OUT 3.

Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
1) INFORMATION 2) MANUAL MODE 3) SET DATE/TIME >4) ACCESSORIES	1-6	2. The screen displays the main menu. Press     to select 4) ACCESSORIES.
1) AQUASENSOR 2) BEEPER 3) AUX IN >4) AUX OUTPUTS	1-12	3. The screen displays the accessories menu. Press     to select 4) AUX OUTPUTS.
>1) AUX OUT 1 2) AUX OUT 2 3) AUX OUT 3	1-4	4. The screen displays the auxiliary outputs menu. Press  to select 1) AUX OUT 1.
AUX1 OUTPUT TYPE Repeat Cycle	Repeat Cycle, Normally Off, Normally On	5. The screen displays the AUX 2 VALV POS setting. Press   or  and then  to select Repeat Cycle.

AUX OUTPUT TYPE	Description
Repeat Cycle (default)	For this option, select a cycle, a delay time and a duration time. In this mode, the relay is energized through all cycles EXCEPT the cycle you designate. Further, it will delay de-energizing the relay for the duration designated. It will de-energize during that cycle for the amount of time you set after the delay.
Normally Off	For this option, select a cycle, a delay time and the duration time. In this mode, the relay is NOT energized through all cycles EXCEPT the cycle you designate. Further, it will delay energizing the relay for the duration designated. It will be energized during the selected cycle for the amount of time you set after the delay.
Normally On	For this option, select a cycle, a delay time, an "on" time, and an "off" time. Once the relay energizes in the selected cycle, it will repeat the "on" time and "off" time settings until the cycle ends.

Screen Display	Range	Procedure
AUX 1 VALV POS Service	Service, Backwash, Brine/SRinse, Fast Rinse, Fill, Bypass, Blocked	6. For repeat cycle auxiliary output type, press  to keep the setting at SERVICE .
AUX 1 OUT DELAY 0 Mins	0-9999	7. Press  to leave the AUX 2 OUT DELAY setting at zero. Set the AUX3 OUT delay to the same value as the AUX2 OUT (the last setting on AUX2). This allows AUX3 to turn on immediately after AUX2 turns off.
AUX OUT 1 0 Gals	0-9999	8. Press   or  and then  to change the capacity, in gallons, of the selected auxiliary output.
AUX1 OUT ACTIVE 0 Secs	0-9999	9. Press   or  and then  to specify the number of seconds needed for the selected auxiliary output to be activated. If the AUX OUT minutes are set longer than the cycle time selected, the AUX OUT will continue running beyond the end of the cycle.
AUX1 OUT OFF 0 Mins	0-9999	10. Press   or  and then  to specify the duration, in minutes, for the selected auxiliary output to be inactive. This selection is available only for repeat cycle auxiliary output type.
SOFTENING JAN-01-12 12:01P		11. Press    to save the settings and return to the home screen.

5) SBT SENSOR

Installing the Smart Brine Tank (SBT Probe) in to the Brine Tank

1. Place the smart brine probe on top of the brine plate as shown in Figure 41.
2. Loop the two zip ties thru the holes in the probe housing and loop the zip ties around the outside of the brine well as shown in Figure 42.

NOTE IMPORTANT! Tighten zip ties securely to prevent movement.

3. Use a zip tie to snug the top of the brine tank probe against the top of the brine well.
4. Route the Smart Brine Tank cable through the hole provided for the brine tubing. See Figure 43.
5. Route the smart brine tank probe cable to an appropriate opening in the valve control housing. Use the strain-relief plug provided with the SBT probe for installation.
6. Plug the SBT probe connector into the circuit board at the position labeled Brine Tank. See Figure 44.



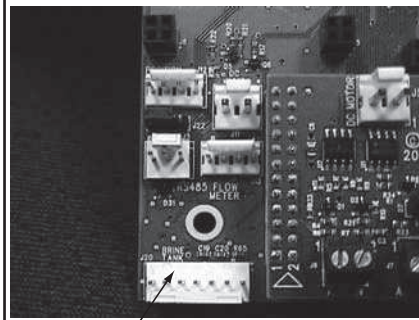
Figure 41.



Figure 42.



Figure 43.



Smart Brine Tank Probe Connection
Figure 44.
























NOTE If the SBT probe is installed in an existing brine tank, or in a tank other than one provided, the probe must be completely out of the brine at the end of the brine draw or the probe will malfunction.

NOTE When adding salt to a brine tank that is using an SBT probe, add enough to completely bury the probe.

Configuring the Smart Brine Tank (SBT) Probe Settings

After the Smart Brine Tank Probe is installed, it is necessary to configure some settings.

NOTE In order for proper probe functioning, it is required that prior to selecting **INSTALLED** on the menu the probe must be physically installed into the brine tank and that the brine tank be filled with a minimum of 16" depth of salt. Failure to take these steps will result in the screen displaying **ERROR MESSAGE**. If these steps were not followed, go to the menu shown below and select **UNINSTALLED**, then press ☒ and ☒ to return to the **HOME SCREEN**. Once the probe is installed correctly and salt is added to the brine tank return to these menus and change the setting back to **INSTALLED**.

Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
1) INFORMATION 2) MANUAL MODE 3) SET DATE/TIME >4) ACCESSORIES	1-6	2. The screen displays the main menu. Press     to select 4) ACCESSORIES .
2) BEEPER 3) AUX IN 4) AUX OUTPUTS >5) SBT SENSOR	1-12	3. The screen displays the accessories menu. Press     to select 5) SBT SENSOR .
SBT SENSOR NOT INSTALLED	Not Installed Installed	4. The screen displays the installation status of the Smart Brine Tank sensor. Press    to change the state to installed. The Smart Controller can then communicate with the SBT sensor.
TANK DIAMETER 18 INCHES	16-150	5. The screen displays the tank diameter setting. Press   or  and then  to increase or decrease the tank diameter, which is used to estimate the number of days the brine tank has salt. Culligan 16" brine tank = 250 lb. salt capacity Culligan 18" brine tank = 375 lb. salt capacity Culligan 24" brine tank = 650 lb. salt capacity
SALT GEOMETRY Pellet/cube	Pellet/Cube, Rock/Solar, Special, Block/ Brick	6. The screen displays the salt geometry (the shape of the softening salts) setting. Press   or  and then  to change the value.
SOFTENING JAN-01-12 12:01P		7. Press    to display the home screen.

6) WIRELESS REM (Wireless Remote)



WARNING! Disconnect all electrical power to the unit before servicing. Bypass the unit and relieve system pressure before attempting repair.



CAUTION! Grip all connections to the circuit board by the connecting terminals for assembly and disassembly. Failure to do so could result in damage to the wire leads or connecting terminals.

1. Select a location for the wireless remote monitor (Figure 45). The location must be near an electrical outlet. If a modem is used in the remote, then the location should also be near a standard RJ-11 type telephone wall jack.



Figure 45. Wireless remote monitor.



CAUTION! Do not touch any surfaces of the circuit board. Electrical static discharges may cause damage to the board. Handle the circuit board by holding only the edges of the circuit board. Keep replacement boards in their special anti-static bags until ready for use. Mishandling of the circuit board will void the warranty.

2. Use the Hole Drilling Template as a guide to drilling two holes to mount the remote monitor (see "Remote Display Template" on page 110). If drilling into wall board, drill two 5/16" diameter holes and insert the plastic drywall anchors into the holes securing them with the two #10 screws provided. If drilling into a solid surface, drill two 7/32" holes into the surface and screw the two #10 screws into the holes. In either case, leave a gap of approximately 3/32" between the head of the screw and the wall.
3. (Optional) If a modem is to be installed into the remote monitor, see "Installing In the Remote" on page 57.
4. Connect the power cord to the bottom of the remote monitor. If a modem is to be used in the remote, plug a standard telephone extension cord into the bottom of the remote monitor.
5. Hang the remote monitor on the two screws.
6. Disconnect power to the softener.
7. Open the control and connect the RF board into the controller circuit board. Make sure the RF board is fully seated into all of the sockets (see Figure 46).
8. Reconnect power.

NOTE The printed Culligan logo will appear upside down on the RF board.

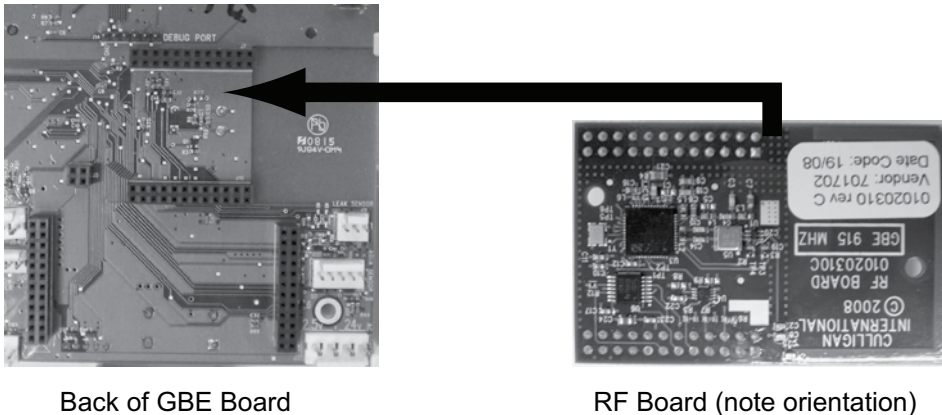


Figure 46. RF board location on GBE board.

9. Install RF board into unit controller. Line up pins in RF board and press firmly into black connectors. Note orientation of RF board in Figure 46.
10. Follow the directions on the next page to program BOTH the main and remote monitor units so they can communicate with each other. If a modem is installed in the remote, it is also necessary to follow the directions in the next section of this manual to configure the main controller to use the modem in the remote.
























Wireless Remote Setup

This setup is completed using the wireless remote device.

Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press <input checked="" type="checkbox"/> to view the main menu.
1) INFORMATION 2) MANUAL MODE 3) BEEPER >4) SETUP	1-6	2. The screen displays the main menu. Press <input type="button" value="↓"/> <input type="button" value="↓"/> <input type="button" value="↓"/> <input checked="" type="checkbox"/> to select 4) SETUP .
>1) RF SETUP 2) MODEM SETUP	1-2	3. The screen displays the accessories menu. Press <input checked="" type="checkbox"/> to select 1) RF SETUP .
CHANNEL # 1	1-254	4. The screen displays the channel number setting. Press <input checked="" type="checkbox"/> <input type="button" value="↑"/> or <input type="button" value="↓"/> and then <input checked="" type="checkbox"/> to select the channel number of the control valve. The CHANNEL # for the control valve must be the same as the CHANNEL # for the Remote Display.
RF FREQUENCY 915MHz	915, 869, 433	5. The screen displays the radio frequency (RF). Do not change the setting from 915 MHz RF frequency for North America installations. Press <input type="button" value="↓"/> to return to the setup menu.
SOFTENING JAN-01-12 12:01P	N/A	6. Press <input type="button" value="X"/> <input type="button" value="X"/> to save the settings and display the home screen.













Control Valve Setup

Now set up the control valve to prompt the Smart Controller to communicate with the installed wireless remote.

Screen Display	Range	Procedure								
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.								
1) INFORMATION 2) MANUAL MODE 3) SET DATE/TIME >4) ACCESSORIES	1–6	2. The screen displays the main menu. Press     to select 4)ACCESSORIES .								
3)AUX IN 4)AUX OUTPUTS 5)SBT SENSOR >6)WIRELESS REM	1–12	3. The screen displays the accessories menu. Press     to select 7)WIRELESS REM .								
REMOTE DISPLAY NOT INSTALLED	Not Installed Installed	4. The screen displays the installation status of the wireless remote. Press    to change the state to installed. The Smart Controller can then communicate with the remote.								
CHANNEL # 1	1–254	5. The screen displays the tank diameter setting. Press   or  and then  to select the channel number of the control valve. The CHANNEL # for the control valve must be the same as the CHANNEL # for the Remote Display.								
RF FREQUENCY 915MHz	915, 869, 433	6. The screen displays the radio frequency (RF). Press   or  and then  to select the appropriate frequency for the installation site. Press  to return to the accessories menu.								
		<table><tr><th>Installation Site</th><th>Radio Frequency</th></tr><tr><td>915</td><td>North America</td></tr><tr><td>869</td><td>Europe</td></tr><tr><td>433</td><td>Asia</td></tr></table>	Installation Site	Radio Frequency	915	North America	869	Europe	433	Asia
Installation Site	Radio Frequency									
915	North America									
869	Europe									
433	Asia									
SOFTENING JAN-01-12 12:01P		7. Press   to save the settings and display the home screen.								

Check Signal Strength

Check the signal strength once the control valve and wireless remote are setup. The signal strength indicator (SSI) will show a value of between 0 and 8. If the SSI is at least 4, then the installation is complete. If the SSI drops below 4, then it may be necessary to select an alternate location within distance for the wireless remote.

Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
3)SET DATE/TIME 4)ACCESSORIES 5)ADV. SETUP >6)DIAGNOSTICS	1-6	2. The screen displays the main menu. Press       to select 6)DIAGNOSTICS.
1)ADVANCED STAT 2)CHECK SENSORS >3)TEST WIRELESS 4)TEST PROGFLOW	1-9	3. The screen displays the diagnostics menu. Press    to select 3)TEST WIRELESS.
WIRELESS TEST 0 / 14 RSS=5		4. The screen displays the status of the wireless test, such as the test number and total number of attempts, and the results of the wireless test, the received signal strength indicator (RSSI).
SOFTENING JAN-01-12 12:01P		5. Press   to save the settings and display the home screen.

7) MODEM

NOTE The modem can be installed into either the back of the main controller or the back of the remote control board. The functionality of the modem is the same in either installation.

1. Unplug the wireless remote before installing the modem into the back of the GBE board or the back of the remote. See Figure 47 and Figure 48.



WARNING! Disconnect all electrical power to the unit before servicing. Bypass the unit and relieve system pressure before attempting repair.



CAUTION! Grip all connections to the circuit board by the connecting terminals for assembly and disassembly. Failure to do so could result in damage to the wire leads or connecting terminals.



CAUTION! Do not touch any surfaces of the circuit board. Electrical static discharges may cause damage to the board. Handle the circuit board by holding only the edges of the circuit board. Keep replacement boards in their special anti-static bags until ready for use. Mishandling of the circuit board will void the warranty.

2. Make sure all of the pins at all four connectors are aligned between the modem board and the main controller board. Make sure that the modem board is fully seated into all four sockets.

3. When all connections have been made restore power.
4. Connect the modem to the telephone line by plugging a standard RJ-11 phone extension cord into the modem board.

NOTE The HE 1.5 Twin is designed to plug into an analog telephone line (standard residential phone line). This includes phone lines connected to most residential VoIP (voice over Internet) phone systems and to residential DSL phone systems. If you are connecting the HE to a DSL phone system, follow the DSL provider recommended method to connect standard phones to the DSL service. Many systems recommend or require the use of DSL line filters between the phone jack and the device.

NOTE Try to place the HE 1.5 Twin Softener or Remote Display near a telephone jack. A splitter might be needed if the jack is already in use.

Installing in the GBE Board

Open the controller cover and locate the modem connection on the back of the board (see Figure 47). Insert line modem board (part number 01020747) into the socket on the back of the board. Make sure that all of the pins in all four connectors are aligned and make sure the modem is fully seated into all of the sockets.

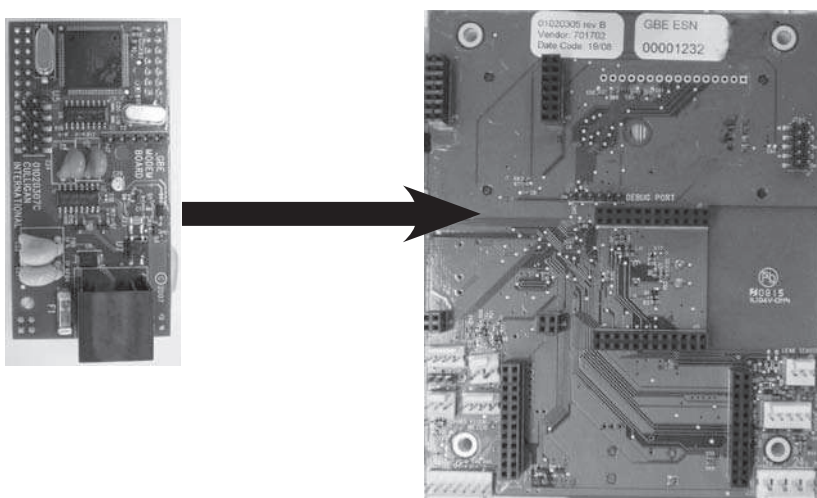


Figure 47. Back of GBE board.

Installing In the Remote

Open the remote monitor housing by removing the two screws and squeezing the sides of the monitor housing slightly. Insert the modem board (P/N 01020747) into the socket on the back of the remote board (see Figure 48). Make sure that all of the pins in all four connectors are aligned and make sure the modem is fully seated into all of the sockets. Snap the two halves of the remote housing back together using light finger pressure and insert the two screws.

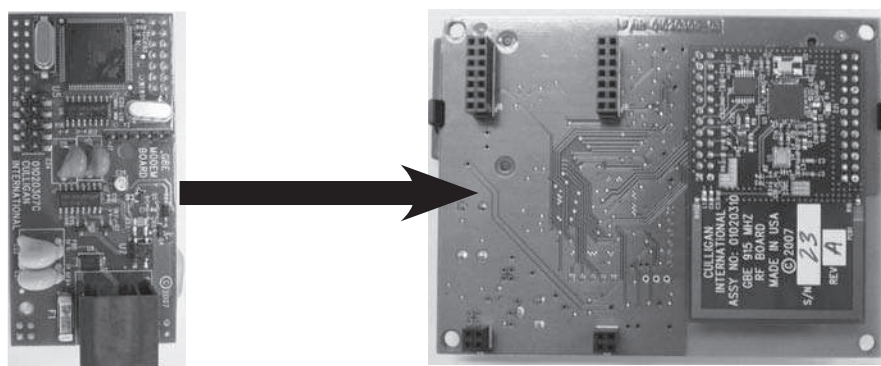





















Figure 48. Back of remote board.

Modem Setup Using Controller















Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
1) INFORMATION 2) MANUAL MODE 3) SET DATE/TIME >4) ACCESSORIES	1-6	2. The screen displays the main menu. Press     to select 4)ACCESSORIES .
4) AUX OUTPUTS 5) SBT SENSOR 6) WIRELESS REM >7) MODEM	1-12	3. The screen displays the accessories menu. Press     to select 7)MODEM .
TEL MODEM NOT INSTALLED	Not Installed Installed	4. The screen displays the installation status of the modem. Press    to change the state to installed if a telephone modem is installed inside the Smart Controller.
MODEM LOCATION IN MAIN CONTROL	In Main Control In Remote	5. The screen displays the modem location setting. Press    to change the location.
NOTE Change this setting only if a modem is installed.		
CALL FREQUENCY EVERY 10 REGENS	0-25	6. The screen displays the call frequency setting. Press   or  and then  to increase or decrease the frequency. The default value of EVERY 10 REGENS can be changed from 0 to 25 successful regenerations. If set to 1, the unit will call in the following morning after each regeneration. The interval can also be set to 0, meaning the unit would NEVER call in unless there was a problem detected. It is recommended for a typical installation the default value of EVERY 10 REGENS is used.

Screen Display	Range	Procedure																
<div>TIME ZONE GMT</div> <div>00:00</div>		<div>7. The screen displays the time zone setting. Press or and then to change the time zone.</div> <div>When using a modem, the controller will occasionally access the Internet to synchronize the date and time. In order to do this correctly, you must specify the time zone in which the controller is installed. The time zone is classified as a number of hours ahead or behind Greenwich Mean Time (GMT). The GMT offset for some common cities is listed below:</div> <table><tr><th colspan="2">GMT Offset</th></tr><tr><td>New York</td><td>-5:00 (and anywhere in EST)</td></tr><tr><td>Chicago</td><td>-6:00 (CST)</td></tr><tr><td>Denver</td><td>-7:00 (MST)</td></tr><tr><td>Los Angeles</td><td>-8:00 (PST)</td></tr><tr><td>London</td><td>0:00</td></tr><tr><td>Paris</td><td>0:00</td></tr><tr><td>Rome</td><td>+1:00</td></tr></table>	GMT Offset		New York	-5:00 (and anywhere in EST)	Chicago	-6:00 (CST)	Denver	-7:00 (MST)	Los Angeles	-8:00 (PST)	London	0:00	Paris	0:00	Rome	+1:00
GMT Offset																		
New York	-5:00 (and anywhere in EST)																	
Chicago	-6:00 (CST)																	
Denver	-7:00 (MST)																	
Los Angeles	-8:00 (PST)																	
London	0:00																	
Paris	0:00																	
Rome	+1:00																	
<div>DEALER ID</div> <div>>_</div>	8 digits, 0–9 plus blank	<div>8. The screen displays the dealer identification setting, an eight-digit number. Press or and then to change each digit of the dealer ID. When the final digit is entered press to accept the entire dealer ID.</div>																
<div>DATA PHONE #</div> <div>18884137028</div>	15 digits, 0–9 plus *, #, -, and comma	<div>9. The screen displays the data phone number, up to fifteen digits. Press or and then to change each digit of the phone number. When the final digit is entered press to accept the entire phone number.</div> <div>Provide a telephone number to be called by the unit. Typically, the unit dials a local access number. These local access numbers, for nearly every area code around the globe, can be found at http://www.myculligan.com/technical/tech_ref-gbe-boards.asp. The unit can be programmed with the default toll-free access number; use a local number whenever possible.</div>																
<div>SOFTENING</div> <div>JAN-01-12 12:01P</div>		<div>10. Press to display the home screen.</div>																

Test Modem

This menu attempts to send a test message. The screen indicates whether or not this process is successful. Sending a test message will also update the time and date on the Smart Controller to the correct time. If the modem is installed on the main controller (as opposed to installed in the remote control) then this testing process will also check to see if there is an updated version of firmware available on the Culligan servers.

After conducting a phone line test, it is important to verify that the new time and date settings on the controller are correct. If the new time setting has the incorrect value for the hours it is likely that the time zone setting on the control is incorrect. The time zone setting found under the Main Menu / Accessories / Modem screen is displayed in the format of GMT +/- X hours. See "Installing In the Remote" on page 57.


















Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
3)SET DATE/TIME 4)ACCESSORIES 5)ADV. SETUP >6)DIAGNOSTICS	1-6	2. The screen displays the main menu. Press       to select 6)DIAGNOSTICS.
6)AUX OUT STAT 7)AUX OUT TEST 8)USE DATA PORT >9)TEST PHONELIN	1-9	3. The screen displays the diagnostics menu. Press     to select 9)TEST PHONELIN.
MODEM TEST Emailing now Please Wait...		4. The screen displays the status of the test before displaying the results. Do not press any buttons before the test is complete or the controller will return to the Diagnostics menu.
SOFTENING JAN-01-12 12:01P		5. Press    to save the settings and display the home screen.

Possible Results

MODEM TEST ERROR NO TONE!!	MODEM TEST NOT POSSIBLE NOW TRY LATER!	MODEM TEST CHECKING FOR NEW FW
MODEM EMAIL SUCCESS	MODEM TEST TIME SET SUCCESS	MODEM TEST NO NEW FW

Modem Setup From Remote Display

This setup is completed using the wireless remote device.

Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
1) INFORMATION 2) MANUAL MODE 3) BEEPER >4) SETUP	1-6	2. The screen displays the main menu. Press     to select 4)SETUP .
1) RF SETUP >2) MODEM SETUP	1-2	3. The screen displays the setup menu. Press   to select 2)MODEM SETUP .
TELEPHONE MODEM INSTALLED		4. The screen displays the installation status of the modem. Press    to change the state to installed if a telephone modem is installed inside the Smart Controller.
LOCAL ISP PHONE 18884137028		5. The screen displays the data phone number, up to fifteen digits. Press   or  and then  to change each digit of the phone number. When the final digit is entered press  to accept the entire phone number.
SOFTENING JAN-01-12 12:01P		6. The screen displays the setup menu. Press   to save the settings and display the home screen.

8) CHLORINATOR

Relay Board/Aux5 Setup

The GBE board offers support for the Culligan Chlorinator/Relay board (PN 01022238). See Figure 49.

To use the chlorinator/relay board, install it onto the back of the GBE board. See Figure 50.

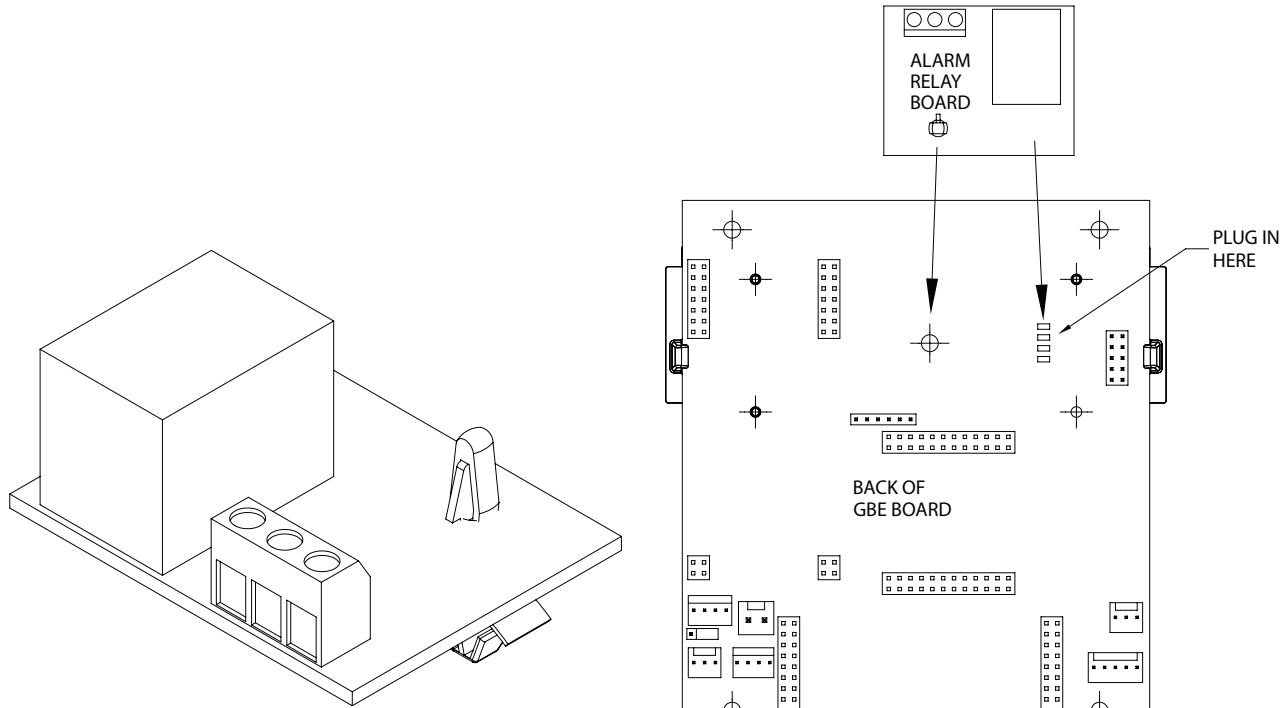


















Figure 49.

Alarm Relay board.

Figure 50.

Alarm Relay Board—>Smart Controller.

Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
1) INFORMATION 2) MANUAL MODE 3) SET DATE/TIME >4) ACCESSORIES	1–6	2. The screen displays the main menu. Press     to select 4)ACCESSORIES .
5) SBT SENSOR 6) WIRELESS REM 7) MODEM >8) CHLORINATOR	1–12	3. The screen displays the main menu. Press         to select 8)CHLORINATOR .
CHLORINATOR >INSTALLED	Not Installed Installed	4. Press    to change the state to installed if a Chlorinator board is installed inside the HE Controller.

Screen Display	Range	Procedure
<div>CHLORINATOR</div> <div>>CHLORINATOR</div>	Chlorinator, Error Status, Network, Normally On, Normally Off, Repeat Cycle	<p>5. Press <input checked="" type="checkbox"/> <input type="up"/> or <input type="down"/> and then <input checked="" type="checkbox"/> to specify how the alarm relay board is used.</p> <p>Chlorinator—Used to control a chlorinator. Not used in commercial/industrial applications.</p> <p>Error Status—This mode of operation occurs when the relay board is plugged into the GBE board chlorinator socket. When Error Status is selected, this relay is in the Normally Open position when the GBE board has power AND there are no errors present (“Problem Found” is not showing on the Home screen). The relay is in the Normally Closed Position when the HE is either powered OFF or when there is an error present on the GBE board.</p> <p>Network—currently not used.</p> <p>Normally On—Sets up relay to be Aux5. For this option, select cycle, delay time and duration. In this mode, the relay is energized through all cycles EXCEPT the cycle you designate. Further, it will delay de-energizing the relay for the duration designated. It will de-energize during that cycle for the amount of time you set after the delay.</p> <p>Normally Off—Sets up relay as Aux5. Select cycle, delay time, and duration. In this mode, the relay is NOT energized through all cycles EXCEPT the cycle you designate. Further, it will delay energizing the relay for the duration designated. It will be energized during the selected cycle for the amount of time you set after the delay.</p> <p>Repeat Cycle—Sets up relay as Aux5. Select cycle, delay time, “on” time, and “off” time. Once the relay energizes in the selected cycle, it will repeat the “on” time and “off” time settings until the cycle ends.</p>
<div>POWER LEVEL</div> <div>HIGH</div>	High, Low, Medium	<p>6. Press <input type="down"/> to change the Chlorinator power level setting. Change this setting only if a Chlorinator is installed.</p>
<div>ON TIME</div> <div>5</div> <div>MINUTES</div>	1–20	<p>7. Press <input checked="" type="checkbox"/> <input type="up"/> or <input type="down"/> and then <input checked="" type="checkbox"/> to specify the number of minutes the chlorinator will operate during the brine draw phase.</p>
<div>SOFTENING</div> <div>JAN-01-12 12:01P</div>		<p>8. Press <input type="x"/> <input type="x"/> to save the settings and display the home screen.</p>

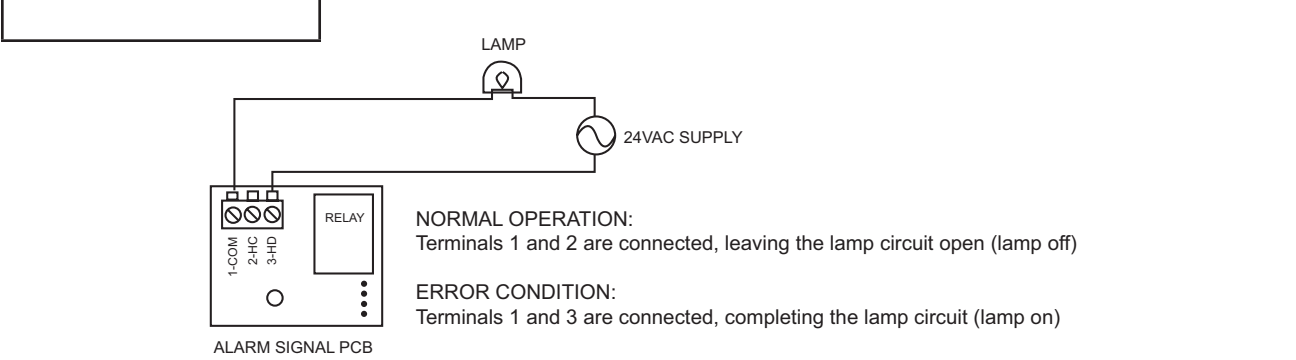


Figure 51. Example of customer wiring to the GBE Alarm Signal Output.

Smart Controller Alarm Signal Output

The Smart Controller Alarm Signal Output is provided thru three screw terminals located on the Plug-in Circuit board. These terminals provide a pair of dry contacts rated at 10 A at 240 VAC. One dry contact is open and one is closed at all times as defined in the table below.

When Smart Controller is...	Contact A (screw terminals 1 & 2)	Contact B (screw terminals 1 & 3)
Operating Normally	Continuity	Open circuit
In "Error Condition", or when the Smart Controller is not powered on	Open circuit	Continuity

A simple error alarm can be constructed by routing a customer supplied power source thru the Alarm Signal Output contact terminals 1 and 3 as shown in Figure 51. The indicating light will be ON any time that the Smart Controller is either not powered on, or if it is in an "error condition." Alternatively, the Alarm Signal Output contact terminals can be wired to a customer supplied PLC or SCADA system to provide an indication to the customer of the status of the Smart Controller equipment.

Error	Add Sensors	Meaning
Motor Pos Err	No	Control valve drive motor or motor position sensors have failed.
Motor Home Err	No	Control valve drive motor or motor position sensors have failed.
Smart Controller is unpowered (or board has failed)	No	Power to the Smart Controller has been interrupted (no alarm signal output).
Ext Filter Alarm	No	Smart Controller has a programmable count-down gallonage alarm. This error indicates that the countdown has reached zero. Typically this alarm is used as a reminder to replace filter media in an external canister filter.
Aqua Salt Error	Aqua-Sensor	The most recent regeneration was unsuccessful because the strength of the brine was too low.
Low Salt Level	SBT Probe	This alarm is a prediction that the solid salt remaining in the brine tank will need to be replenished within the next 14 or fewer days. (The predicted days-salt-remaining can be viewed on the Smart Controller display screen.)
Brine Overfill	SBT Probe	There is too much water in the brine tank.
Brine Blocked	SBT Probe	The rate of brine draw during the most recent eduction was too slow. The eduction system is either partially clogged or a vacuum leak has formed in the eduction system. -or- There was not enough water in the brine tank at the end of fill (which could also be due to a blocked brine line).
Salt Bridging	SBT Probe	There appears to be a salt bridge in the brine tank.
No RF Remote Signal	RF wireless remote	The controller has lost RF communication with the Smart Controller wireless remote.

Table 9. Error Conditions on the Smart Controller which will trigger the Alarm Signal Output.

On a multiple-tank softener system, such as a twin-alternating, or progressive flow network, the Alarm Signal Output Relay board must be installed on each Smart Controller that the user wants monitored for errors.

When the Smart Controller senses any of the error conditions listed in the table above, the alarm output signal will be triggered. In order to determine the actual individual error(s) which triggered the alarm output signal to be triggered, you would either need to refer to the Smart Controller display screen itself, or to use the PLC communication process described in this installation manual.

9) FLOW METER (External Flow Meter)






















Programming Flow Profiles for a HE-090

The low flow limit can be set to any low value. Consider setting it at the minimum flow rate shown in the manual. This is usually calculated using 2 gpm per square foot of bed area. The HE-090 has a 16" diameter tank, so its cross section is 1.4 square feet (area = $\pi * r^2$). 1.4 sf * 2 gpm is 2.8, rounded up to 3. Next you can set the high flow limit at the unit's rated peak flow, in this case 38 gpm. Here is what the controller is going to do.

First it will take the high flow limit and subtract the low flow limit: $38 - 3 = 35$. It then divides this into four equal divisions: $35 \div 4 = 8.75$, and then tracks six separate values or flow profiles. The flow profile values are displayed in minutes.

















- Profile 1 is any flow below the low flow limit.
- Profile 2 is any flow from 3 to 11.75 gpm
- Profile 3 is any flow from 11.76 to 20.51 gpm
- Profile 4 is any flow from 20.52 to 29.26 gpm
- Profile 5 is any flow from 29.27 to 38 gpm (the high flow limit)
- Profile 6 is any flow above the high flow limit.

View flow profiles through the Diagnostics menu. Go to ADVANCED STATS then FLOW STATS and scroll down to FLOW PROFILE R1 through R6. The values displayed are the number of minutes the flow rate has been in that range.

Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
1) INFORMATION 2) MANUAL MODE 3) SET DATE/TIME >4) ACCESSORIES	1-6	2. The screen displays the main menu. Press     to select 4) ACCESSORIES .
6) WIRELESS REM 7) MODEM 8) CHLORINATOR >9) FLOW METER	1-12	3. The screen displays the accessories menu. Press      to select 9) FLOW METER .
FLOW METER 47.00 PULS/GAL	0.1-500	The screen displays the flow meter settings for the device connected to the controller. Do not change this setting. Press  to view the next setting. NOTE HE softeners and filters are set at 47.0 Puls/Gallon.
LOW FLOW LIMIT 1 GPM	1-500	4. The screen displays the low flow limit in gallons per minute. Press   or  and then  to change the limit. See the flow profiles for more information about this setting.
HIGH FLOW LIMIT 9 GPM	1-500	5. The screen displays the high flow limit in gallons per minute. Press   or  and then  to change the limit. See the flow profiles for more information about this setting.
SOFTENING JAN-01-12 12:01P		6. Press   to display the home screen.

10) SERVICE PHONE (Service Phone Number)


If the Modem is not installed it is possible, in addition to displaying the error message, to display a message that reads "Call Culligan at: XXXXXXXXXX" where the telephone number XXXXXXXXXX can be programmed by the dealership (typically programmed to be the telephone number of the dealership).

Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
1) INFORMATION 2) MANUAL MODE 3) SET DATE/TIME >4) ACCESSORIES	1-6	2. The screen displays the main menu. Press     to select 4)ACCESSORIES .
7) MODEM 8) CHLORINATOR 9) FLOW METER >10) SERVICE PHON	1-12	3. The screen displays the accessories menu. Press     to select 10)SERVICE PHON .
SERVICE TEL >_	15 digits, 0-9 plus *, #, -, and comma	4. The screen displays the service phone number, a fifteen-digit number. Press   or  and then  to change each digit of the phone number. When the final digit is entered press  to accept the entire phone number.
SOFTENING JAN-01-12 12:01P		5. Press   to display the home screen.































11) EXT. FILTER (External Filter)

The unit can provide alarm feedback for a sediment or carbon filter installed upstream of the unit. The Auxiliary filter alarm can be initiated based on flow or time.

To use this feature it is necessary to specify the total lifetime totalized capacity of the auxiliary filter or days. Once set, it will begin to track the total gallons or days. Once the total capacity reaches the specified lifetime totalized gallons or days, the system will display the alarm message "Change Auxiliary Filter" on the main display as well as the remote display and via the telephone modem if these secondary devices are used.

CHANGE AUXILIARY FILTER	1. When the screen displays CHANGE AUXILIARY FILTER , press  to view the main menu.
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NOTE Once the auxiliary filter has been replaced, the auxiliary filter alarm must be reset by returning to the same menu: Main Menu—>Accessories—>Auxiliary Flow Alarm.

Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
1) INFORMATION 2) MANUAL MODE 3) SET DATE/TIME >4) ACCESSORIES	1-6	2. The screen displays the main menu. Press     to select 4) ACCESSORIES.
8) CHLORINATOR 9) FLOW METER 10) SERVICE PHON >11) EXT. FILTER	1-12	3. The screen displays the accessories menu. Press     to select 11) EXT. FILTER.
EXT FILTER ALRM NOT INSTALLED	Not Installed Installed	4. The screen displays the installation status of the external filter. If a filter is installed, press    to change the state to installed.
FILTER CAPACITY FLOW BASED	Flow Based Time Based	5. The screen displays the filter capacity basis. Press   or  and then  to change the setting.
FILTER CAPACITY 100000 GALLONS	0-100000000	6. If flow based, the screen displays the filter capacity in gallons. Press   or  and then  to change the setting.
FILTER CAPACITY 365 DAYS	1-999	7. If time based, the screen displays the filter capacity in days. Press   or  and then  to change the setting.
RESET CAPACITY NO	No Yes	8. The screen displays the reset capacity, a confirmation query. Press   or  and then  to change the setting from NO to YES when the alarm is first set up and when the cartridge filter is replaced.
SOFTENING JAN-01-12 12:01P		9. Press   to display the home screen.

Manual Regeneration



Follow either procedure to bypass the softener or to initiate a manual regeneration at the control valve or the remote display.

NOTE In multi-tank systems, the regeneration request is sent to the master control. It will allow the unit to regenerate at the next available time.


NOTE Once regeneration is initiated the status can be changed only after the process is complete or by re-setting the motor control in the Diagnostics menu.

Quick Manual Regeneration















Delayed Regeneration

Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  and hold for at least five (5) seconds.
REGEN TONITE JAN-01-12 12:01P	Regen Tonite	2. The screen displays the regeneration status on the first line of the display. The system will regenerate at a scheduled time.
REGEN OFF JAN-01-12 12:01P	Regen Off	3. To cancel a delayed regeneration, press  and hold for at least five (5) seconds. The screen displays the new status.

Immediate Regeneration















Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  and hold for at least ten (10) seconds.
REGEN NOW JAN-01-12 12:01P	Regen Now	2. The screen displays the regeneration status on the first line of the display. The softener will initiate an immediate regeneration.
REGENERATING JAN-01-12 12:01P	N/A	3. The first line of the screen displays REGENERATING .

Standard Manual Regeneration

Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
1) INFORMATION >2) MANUAL MODE 3) SET DATE/TIME 4) ACCESSORIES	1-6	2. The screen displays the main menu. Press   to select 2)MANUAL MODE.
MANUAL MODE REGEN NOW	Regen Off Regen Now Regen Tonite Bypass	3. The screen displays the manual regeneration menu. Press   or  and then  to change the setting. REGEN NOW is the default. REGEN OFF specifies that the softener will not regenerate. REGEN TONITE specifies that the softener will regenerate that night at 2:00 a.m. (or at the preset regeneration time). The screen displays two status messages: SOFTENING and REGEN TONITE . BYPASS specifies a preset time when the softener will be bypassed. Press  to select the total time the softener is to be in the bypass state.
MANUAL BYPASS OFF	Off 30 (min) 60 90 120 180 Manual Bypass	4. The screen displays the manual bypass duration. This specifies the total time the softener is to be in the bypass state. Press   or  and then  to change the setting.
SOFTENING JAN-01-12 12:01P		5. Press   to display the home screen.

Manual Cycling

Manual cycling can be performed when the unit is starting either in **SERVICE** or while it is already within any portion of the **REGENERATION** process. If the unit is currently regenerating, the name of the current cycle position and the number of minutes remaining in the current cycle position will be displayed.

Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
3)SET DATE/TIME 4)ACCESSORIES 5)ADV. SETUP >6)DIAGNOSTICS	1-6	2. The screen displays the main menu. Press       to select 6)DIAGNOSTICS.
4)TEST PROGFLOW >5)MOTOR CONTROL	1-9	3. The screen displays the diagnostics menu. Press      to select 5)MOTOR CONTROL.
MOTOR AT POS 1 UP:FWD DWN:REV	1-6	4. If control is not in regeneration, the screen displays the motor control status. If cycling during service, press  to to cycle the control valve without stopping. Press  to move the motor to another position (such as from 1 to 2).

Position Indicator	Gearbox Status
MOTOR AT 1	Service position
MOTOR AT 2	Backwash position
MOTOR AT 3	Brine Draw position
MOTOR AT 4	Fast Rinse position
MOTOR AT 5	Fill position
MOTOR AT 6	Bypass position

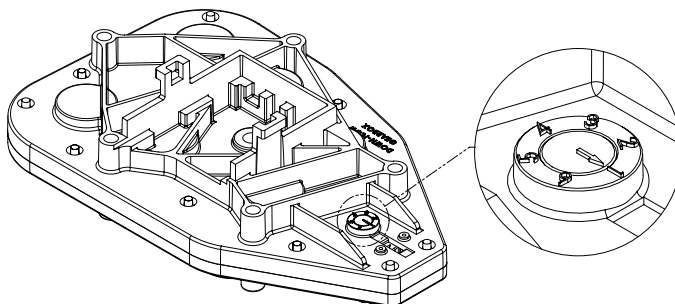


















Figure 52. Gearbox position indicator.






BACKWASH MIN LEFT NEXT CYCLE	Next Cycle End Regen Now End/Cancel Trig	5. If cycling during regeneration, press   or  and then  to change the regeneration setting.
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NOTE Manual regeneration may trigger false error messages on systems using Aqua-Sensor and/or SBT probes. Ignore the error messages; the errors will be cleared after the next normal regeneration.

SOFTENING JAN-01-12 12:01P	6. Press   to display the home screen.
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The following information can be displayed at the control valve or remote display. These settings are read-only. Press  or  to scroll through the settings. Press  to view the previous setting.

Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
>1) INFORMATION 2) MANUAL MODE 3) SET DATE/TIME 4) ACCESSORIES	1-6	2. The screen displays the main menu. Press  to select 1) INFORMATION.
SALT TANK LEVEL Low	OK, Overfill, Low	3. This screen is displayed if a Smart Brine Tank sensor is installed and the probe detects out-of-range salt levels (error conditions Low Salt Level or Brine Overfill). Press  to view the next setting.
..SALT REMAINING APPROX 1 DAYS	1-15	4. The screen displays the estimated calculated number of days that the media can effectively treat water. This screen is displayed only when the SALT TANK LEVEL = Low . Press  to view the next setting.
REMAIN CAPACITY 100%	0-100	5. The screen displays the softening capacity remaining, displayed as a percentage of the total capacity. During manually initiated regeneration, assume 0 percent remaining capacity. Press  to select the next information screen.
REMAIN CAPACITY 700 GAL	0-no limit	6. The screen displays the softening capacity remaining, measured in gallons (liters). Press  to see the next information screen.
CURRENT FLOWRATE 0.0 GPM	0-no limit	7. The screen displays the current flow rate, measured in gallons (liters) per minute. Press  to see the next information screen.
TODAY'S USAGE 0 GALLONS	0-no limit	8. The screen displays today's water usage since midnight, measured in gallons (liters). Press  to see the next information screen.
AVERAGE DAILY 310 GALLONS	0-no limit	9. The screen displays average water usage for this configuration. Press  to see the next information screen.

Screen Display	Range	Procedure
NEXT REGEN ON JAN-05	N/A	10. The screen displays the date of the next regeneration, based on average daily water usage. Press  to see the next information screen.
TOTAL WATER USED 10000 GALLONS	0-no limit	11. The screen the total water used for this configuration. Whole numbers are displayed above 100 gallons. Press  to see the next information screen.
EXT FILT CAP REM 20 DAYS	0-no limit	12. If an external filter is used, the screen displays the remaining capacity of the filter. When the remaining capacity reaches zero, the system triggers the External Filter Alarm. Press  to return to the main menu.
SOFTENING JAN-01-12 12:01P		13. Press   to display the home screen.

Initial Backwash of the System

1. Referencing the instructions in “Manual Cycling” on page 70, cycle the control to the backwash position.
2. Cycle the control through the remaining steps and back to the home (service) position.

Installation Wrap Up

“High Efficiency Twin 1.5 Water Softeners—Flow Rate Data (gpm)” on page 128 provides the expected flow rates to the drain during the various steps of the regeneration process.

Fill the Salt Storage Container

Before filling the brine tank with salt, refer to “High Efficiency 1.5 Twin Refill Minutes/Salt Dosage/Capacity” on page 129 to find the salt dosage and capacity rating per regeneration.

Dry Storage

If the salt dosage/capacity rating falls within the non-shaded area, fill the storage container to within a few inches of the top. This is called dry salt storage; see Figure 53. When the proper amount of water is returned to the salt storage tank during brine refill, the salt level is higher than the water level.

Wet Storage

If the salt dosage/capacity rating falls within the shaded area, the amount of salt that can be put in the salt container is limited. Since the salt level will be below the water level, this is called wet salt storage; see Figure 54. When the correct amount of water has been returned to the salt storage tank, all the salt is under water. Refer to “Resin Bed Depths and Estimated Capacity Per Inch at Various Salt Dosages” on page 127 to determine how much salt can be added.

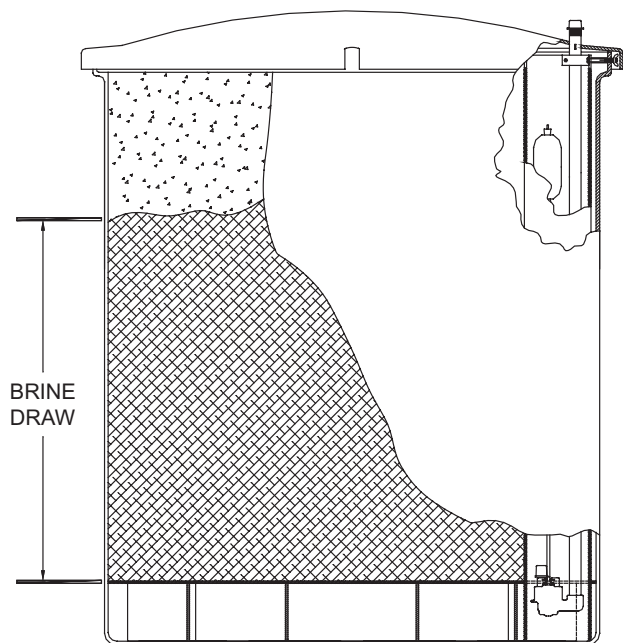


Figure 53. Dry storage.

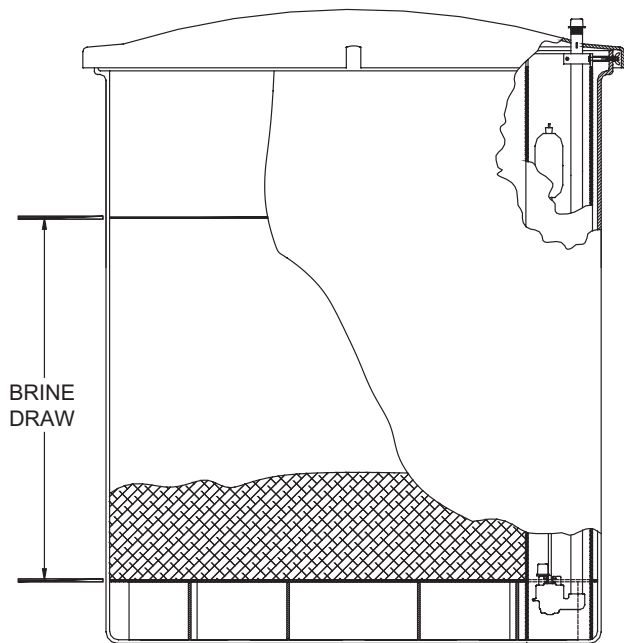


Figure 54. Wet storage.

Creating Brine

Once salt has been added to the brine tank the control valve must be manually cycled to the brine refill cycle to create the required amount of brine for the unit's first regeneration. Allow the valve to refill for the cycle #5 programmed time.

NOTE If the control valve is not cycled to the brine refill cycle there will be no brine for regeneration.

NOTE The salt level must be checked frequently; in some cases, after each regeneration. After the brine refill step is finished, add salt. To ensure complete brine saturation in wet storage, maintain a salt depth of at least 18 inches.
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Recommended Meter Start-Up Procedure

1. Close the main water supply valve.
2. Ensure that all faucets at the installation site are closed.
3. Direct the drain line discharge into a bucket where flow can be observed.
4. Plug the transformer into a 120 Volt, 60 Hz, single-phase receptacle. The screen displays **FIRST TIME SETUP** (see page 36).
5. Complete the First Time Setup.
6. Open the main supply valve.
7. Initiate an immediate regeneration to move the control into the **BACKWASH** position.
8. Refer to the section on manual cycling for information on cycling the control through its positions.
9. When in the **BACKWASH** position, slowly rotate the bypass (if installed) to the soft water position until water flows.
10. Allow the tank to fill slowly until water flows from the drain line.
11. When flow to drain is established, open the bypass (if installed) fully. Watch the drain line discharge for signs of resin. If signs of resin particles appear, reduce the flow. Increase the flow again when resin no longer appears in the discharge.
12. After the **BACKWASH** runs clear, step the control to the **REFILL** position to fill the brine tank and purge air from the brine line.
13. Complete the installation and cleanup.
14. Sanitize the unit as you leave the installation site (See page 105).
15. Initiate an immediate regeneration, or set to regenerate at the preset time.

Recommended Aqua-Sensor® Start-Up Procedure

NOTE You might find it useful to pre-test the Aqua-Sensor probe in your shop using the test detailed on page 81. The same test setup can be used in the field.

1. Close the main water supply valve.
2. Install the sensor probe into the tank.
3. Ensure that all faucets at the installation site are closed.
4. Direct the drain line discharge into a bucket where flow can be observed.
5. Plug the transformer into a 120 Volt, 60 Hz, single-phase receptacle (make sure to connect both 24V and 2.5V properly).
6. Complete **FIRST TIME SETUP** (see page 36). The Aqua-Sensor probe is to be set to “NOT INSTALLED” during the initial Start-Up Procedure.
7. Open the main supply valve.
8. Initiate an immediate regeneration to move the control into the **BACKWASH** position.
9. Refer to the section on manual cycling for information on cycling the control through its positions.
10. When in the **BACKWASH** position, slowly rotate the bypass (if installed) to the soft water position until water flows.
11. Continue **BACKWASH** until the drain effluent is clear and the Aqua-Sensor probe is placed in the resin bed—at least 10 minutes (use a white foam coffee cup to occasionally collect a sample of backwash water; the stark white of the cup will show the presence of color throw and resin fines).
12. Continue or repeat the **BACKWASH** cycle if needed.
13. After the backwash water runs clear, step the control to the **REFILL** position to fill the brine tank and purge air from the brine line.
14. Unplug the control and connect the sensor to the circuit board.
15. Reconnect the power and **INSTALL** the Aqua-Sensor Probe (Main Menu/ Accessories/ AquaSensor)
16. Check the condition of the Aqua-Sensor (Main Menu/ Diagnostics/ Checksensors)
17. Press the Program key and program the control to the desired settings.
18. Complete installation and cleanup.
19. Sanitize the unit as you leave the installation (see page 105).
20. Initiate a delayed regeneration.

The thorough backwashing process should have cleared the fines and color-throw from the tank. The probe should settle into the resin bed during the first couple of minutes of backwashing.

Before Leaving the Installation Site

1. Clean up the unit and the installation site, removing any soldering or pipe threading residues from the equipment with a damp towel.
2. Explain the operation of the softener and bypass valves to the customer.
3. Advise the customer to check and replenish the salt supply regularly.

Wrap Up Checklist

Once you have completed the installation the system is ready to be placed in service. Prior to placing the system in service review the following checklist to be sure the system is properly installed.

Check List

- ✓ The media tank(s) has been properly loaded with gravel and media.
- ✓ The drain line has been properly installed.
- ✓ All option kits have been properly installed.
- ✓ The system has been properly piped and tubed.
- ✓ Each media tank has been backwashed manually.
- ✓ The GBE controller(s) have been correctly and completely wired, including differential pressure switches if equipped.
- ✓ All GBE controllers have been properly programmed and are active (power on).
- ✓ All manual isolation valves are open and system by-pass valves are closed.
- ✓ Clean up the unit and the installation site, removing any soldering or pipe threading residues from the equipment with a damp towel.
- ✓ Explain the operation of the system and the Suggested Preventive Maintenance Inspection Schedule (page 104) to the customer.

Care and Cleaning

Protect the operation and appearance of the water conditioner by following these precautions:

1. Do not place heavy objects on top of the conditioner cover.
2. Use only mild soap and warm water to clean the exterior of the unit. Never use harsh abrasive cleaners or compounds which contain acid or bleach.
3. Protect the conditioner and drain line from freezing temperatures.
4. Reset the time, if required, after any interruption of electrical power to keep the unit on its normal schedule.

Troubleshooting Guide




WARNING! The valve **MUST** be depressurized before removing any quick connection clips for servicing. Push the connector toward the control while removing the clips.






Problem/Symptom	Cause	Solution
1. Unit has blank display	Unit has no power	Verify that unit is connected to a constant power source (Not an outlet on a switch)
	Defective plug-in transformer	Replace plug-in transformer
2. Softener fails to automatically initiate a regeneration	Electrical service to the unit has been disrupted	Verify that unit is connected to a constant power source (Not an outlet on a switch)
	Meter not properly recording total gallons used. The flow meter connection and operation can be verified using the test mode setting on the circuit board.	Verify that meter cable is plugged into circuit board. Verify that meter cable is snapped into flow meter housing. Verify that flow meter has not become plugged with debris.
	Incorrect programming	Refer to the 'Programming' section and verify all settings.
3. Regeneration occurs at incorrect time	Timer setting incorrect	Reset timer
	Timer flashing	Reset timer and verify that unit is connected to a constant power source.
	Circuit board set to immediate regeneration	Set circuit board to delayed regeneration. See "Delayed Regeneration" on page 68.
	Incorrect programming	See "Regeneration Triggers Setup" on page 43 and verify all settings.
4. Hard water to service. The root cause of hard water to service may also lead to problems such as iron or hardness bleed in softener.	Salt or Chemical storage tank is empty	Add salt or chemical to storage tank and verify that proper level of salt or chemical is maintained
	Eductor screen or nozzle plugged	Clean or replace eductor nozzle and/or screen
	Incorrect programming (Salt dosage too low for influent hardness)	Refer to the Programming section and verify that settings are correct.
	Insufficient water flowing to salt storage tank	Verify that refill settings are correct and clean the refill flow restrictor.
	Internal seal leak	Replace pistons
	Excessive water usage	Verify that programming is correct for Time Clock units increase regeneration frequency.
	Unconditioned water in water heater tank	Flush water heater to fill tank with conditioned water.
5. Loss of water pressure	Control and/or resin bed plugged with debris or iron build-up	Clean control and increase frequency of regenerations or length of backwash. Plant recondition if necessary
	Inlet manifold plugged	Remove control from tank and clean inlet manifold. Check if eductor screen/nozzle are also plugged.
	Control plugged with foreign material broken loose from recent plumbing work.	Clean control.

Problem/Symptom	Cause	Solution
6. Loss of mineral to drain	Improper drain line flow control	Ensure that the control has the proper drain line flow control.
	Air in water system	Ensure that system has proper air eliminator control.
7. Mineral to service	Defective outlet manifold	Replace outlet manifold
8. Water in brine storage tank up to float	Plugged drain line flow control (Unit will not draw brine)	Clean drain line flow control.
	Plugged eductor system (Unit will not draw brine)	Clean eductor screen and nozzle
	Slow leak to brine line. Faulty brine piston.	Replace brine piston.
	Power outage while control was in refill position	Verify that item A, B, or C is not the cause for the extra water in the storage tank.
9. Excessive water in salt storage tank (Water above brine valve float).	Faulty brine valve; float shut-off failure. When the brine valve is faulty, one of the items listed under problem 8 is also required in order to produce excessive water in the storage tank .	Clean brine valve, replace stem seat, or replace brine valve.
10. Unit fails to refill storage tank.	Refill restrictor plugged.	Clean or replace refill restrictor.
	Air in brine line causes float to slam shut (float rod is rigid).	Verify that all tubing connections are properly assembled.
11. Unit fails to draw brine or chemical.	Drain line flow control is plugged.	Clean drain line flow control.
	Plugged eductor system.	Clean or replace eductor screen or nozzle.
	Line pressure too low.	Increase line pressure to a minimum of 30 psi (210 kPa).
	Internal control leak.	Replace pistons.
	Drain line too long or restricted.	Verify proper drain line length. See page 20.
	Eductor is drawing air into system.	Verify that all tubing connections are properly assembled.
12. Unit uses an excessive amount of salt or chemical.	Incorrect programming.	Refer to the Programming section and verify all settings.
	Excessive water in storage tank.	Refer to problems 8 & 9.
13. Continuous flow to drain.	Internal piston leak.	Replace pistons.
	Piston jammed in position.	Replace pistons.
	Power failure while unit was in regeneration.	Restore power to unit. Verify that unit is connected to a constant power source.
14. Salt water to service.	Inadequate Brine/Rinse setting for desired salt dosage.	Refer to the Programming section and verify all settings.
	Low water pressure lengthens brine draw time.	Increase line pressure to a minimum of 30 psi (210 kPa).
	Too much brine in the storage tank.	Refer to problems 8 and 9.

Error and Alert Codes

When the Smart Controller identifies that an error has occurred, it is programmed to take steps to attempt to correct the error on its own. If it is unable to correct the problem, the controller will display the message "PROBLEM FOUND." When an error message is displayed (on either the Smart Controller or the remote display), press  on the keypad to display the detected error condition(s). Some of these messages will also provide additional information to help correct the error.

The following error messages may display on both the Smart Controller display as well as the Remote Display (if one is connected).

If the main screen displays "PROBLEM FOUND" it indicates that there are one or more errors detected. Press  to display the first error present. Press  to show any additional errors present. At the bottom of this list the user can press the  to clear the error or press  to exit. Press  when the screen displays the "CLEAR THE ERROR" message to check to see if the error condition still exists; if it still exists, the error will remain displayed on the main screen. If the error no longer exists the main menu will display SYSTEM OK.

Error	Reason for Error	Comment/ Clearing Error Message
Position Sensor Error	The motor is turning, but the position sensor appears to be incorrect.	Check the motor using manual motor control and the position sensors using Main Menu / Advanced / Diagnostics Sensors.
Motor Position Error	Motor did not move when it should. No feedback from switches.	Use manual motor control to see if motor is actually working and not jammed. Use Diagnostics/ Sensor menu to verify that the optical or mechanical position switches are working. Verify the selected value.
Brine blocked	The flow rate of brine or water to or from the brine tank is fully or partially blocked.	Check brine line for blockages or air leaks. Check eductor and eductor screen for blockages.
Replace Filter Media	Total gallons thru the unit has exceeded the specified capacity of the media.	Replace the media. Reset the media filter life at Main Menu/ Advanced Setup/Regen Settings/ Media Life.
Replace Aux Filter Media	Total gallons thru the secondary filter (i.e. "Big Blue" filter) has exceeded the specified capacity of the big blue.	Replace optional filter cartridge. Reset the aux. Filter media life at Main Menu/ Accessories/ Aux Filter menu.
Call Culligan at xxx-xxx-xxxx	This message is displayed if an error has been detected that requires servicing and no modem installed in the system.	Call the number shown. If possible, place this call using a phone that will allow you to see and enter changes to the main controller if required by the service technician during the call.
Salt Bridging	Brine tank has low concentration of brine.	Use a tool to break up any salt bridge inside the brine tank.
xx days salt remaining	This is a prediction of the number of days until it will be necessary to add salt to the brine tank.	Salt can be added to the brine tank at any time. It is recommended that the brine tank be filled to approximately 2/3 full.
Aqua-Sensor® Salt Error	Aqua-Sensor did not detect brine during the regeneration cycle.	Check brine tank. Add salt if necessary. Check Z ratio of the Aqua-Sensor® at Main Menu/ Advanced / Diagnostics/ Sensors.
No Remote RF Signal	Main board is not receiving a signal from the remote.	Remote is off, out of range or on a different channel from the main board. If interference is suspected, try moving the remote closer or switching to a different channel on both the main and remote units.
Low Salt level	Salt level is low; less than 15 days of salt remaining.	Contact Culligan dealer for salt delivery or fill brine tank with salt.
Low battery	Battery needs replacement.	Replace with Panasonic Model# CR 2032 3V battery.

Error	Reason for Error	Comment/ Clearing Error Message
Brine overflow	<p>Too much water in brine tank.</p> <p>Plugged drain line flow control (Unit will not draw brine).</p> <p>Slow leak to brine line.</p> <p>Faulty brine or refill piston.</p> <p>Power outage while control was in refill position.</p>	<p>Check eductor; check for brine draw.</p> <p>Clean drain line flow control.</p> <p>Clean eductor screen and nozzle.</p> <p>Replace brine and refill piston.</p>
No Refill	<p>Failure to refill brine tank. Refill restrictor plugged.</p> <p>Air in brine line causes float to slam shut.</p>	Clean or replace refill restrictor. Verify all tubing connections are properly assembled.
Motor Home Error	Incorrect valve type selected.	Change the valve type using the Advanced Setup/ Valve Type menu then return to the home screen. The screen will blank while the unit reinitializes.

Brine System Analysis

1. WATER LEVEL in the brine tank
 - a. Empty
 - b. Below level of safety valve
 - c. At level of safety valve float
2. SAFETY VALVE in brine tank
 - a. Fiberglass rod travels up and down freely (approximately 1/2")
 - b. Fiberglass rod is rigid

If the brine system is functioning properly, there will be water in the brine tank, but the level should be below the safety valve float and the fiberglass rod should travel freely. If these conditions do not exist, one of the following conditions will indicate the nature of the problem:

1. NO WATER IN BRINE TANK—ROD TRAVELS FREELY. The flow control is plugged. Remove refill flow control. Clean or replace.
2. NO WATER IN BRINE TANK—ROD IS RIGID. Air or water slammed the safety valve closed before water could enter the tank. Clean parts at the base of the brine safety valve and also make sure that the seat of the check valve in the brine line is clean. Check for possible air leaks in the brining system.
3. WATER IN BRINE TANK UP TO SAFETY VALVE FLOAT—ROD IS RIGID. There are possible causes:
 - a. Brine piston is not in service position when control is in service or brine piston seals are defective. Remove brine line while in service. There should be no flow to brine tank.
 - b. Refill flow rate is too high or refill time length is too long. Check refill flow rate and compare to specification in Appendix C, page 128.

Aqua-Sensor® Troubleshooting

The following procedure will help you diagnose problems in units equipped with Aqua-Sensor® sensing device. Because many sensor problems are actually regeneration problems, it contains a combination of sensor diagnostics and routine control valve and brine system checks. Refer to the Troubleshooting Flow chart for the recommended sequence and Appendix B for suggested Aqua-Sensor® application guidelines and "Check Sensors" on page 90.

Testing

AQUASENSOR SUPPLY VOLTAGE 2.5VAC: PASS SIM TEST: PASS
--

1. Verify there is 2.5VAC power supply at the High Efficiency circuit board for the Aqua-Sensor.
2. Record the program and statistical information (last slow rinse, Z ratio, Z minute, and Z increase %) before beginning this procedure.
3. Unplug the unit.
4. Remove the Aqua-Sensor cable from the board.
5. Connect the Soft-Minder Meter/Aqua-Sensor Tester (same as Aqua-Sensor, Part No. 01017705) to the board. The color of the wire on the far right, as you look at the back of the board, should be white.
6. The toggle switch can be in the Balanced or Unbalanced position.
7. Apply power to the unit.
8. Go to the Aqua-Sensor troubleshooting screen (Main Menu—>Diagnostics—>Check Sensors).
9. The screen displays a pass/fail message for the supply voltage and simulator test, checking the Aqua-Sensor circuit and the Z ratio.
10. The board is good if the screen displays 2.5VAC: PASS and SIM TEST: PASS. The transformer might need to be replaced if the screen displays 2.5VAC: FAIL.

Sensor Probe Resin Test

The Probe Resin Test uses fully regenerated, but previously used, Cullex® resin to simulate a balanced environment. Run this test only on a circuit board that has passed the Circuit Board Test with simulator device.

Preparation

You will need a container that can hold enough regenerated Cullex resin to completely immerse the probe's electrodes without making contact with the container's sidewall. A section of PVC pipe, either 2" or 3", makes a suitable chamber for testing either residential or commercial probes.

1. Cut a piece of pipe about 18 inches long and close the bottom end with a cap or a flat piece of PVC (which can also serve as a base)
2. Close the other end with a cap that has been drilled and tapped for a 1" PVC pipe plug, or use a reducing adapter and plug.
3. Fill the chamber with used, regenerated Cullex resin and soft water; the water level should be at least one inch above the resin (when not in use, plug the end to prevent spillage of resin and water)

Probe Test

1. Remove the probe from the resin tank. Make sure pressure is relieved on tank before removing probe.
2. Visual inspection
 - a. Look for discoloration (brown film or blue spots) on electrode fins.
 - b. If discolored, try cleaning the probe (Sofner-Gard™ chemical or white vinegar). The fins can be lightly scrubbed with a soft toothbrush.

Testing

AQUASENSOR	
Zratio	429496
Zminimum	0.000
00.0% Increase	

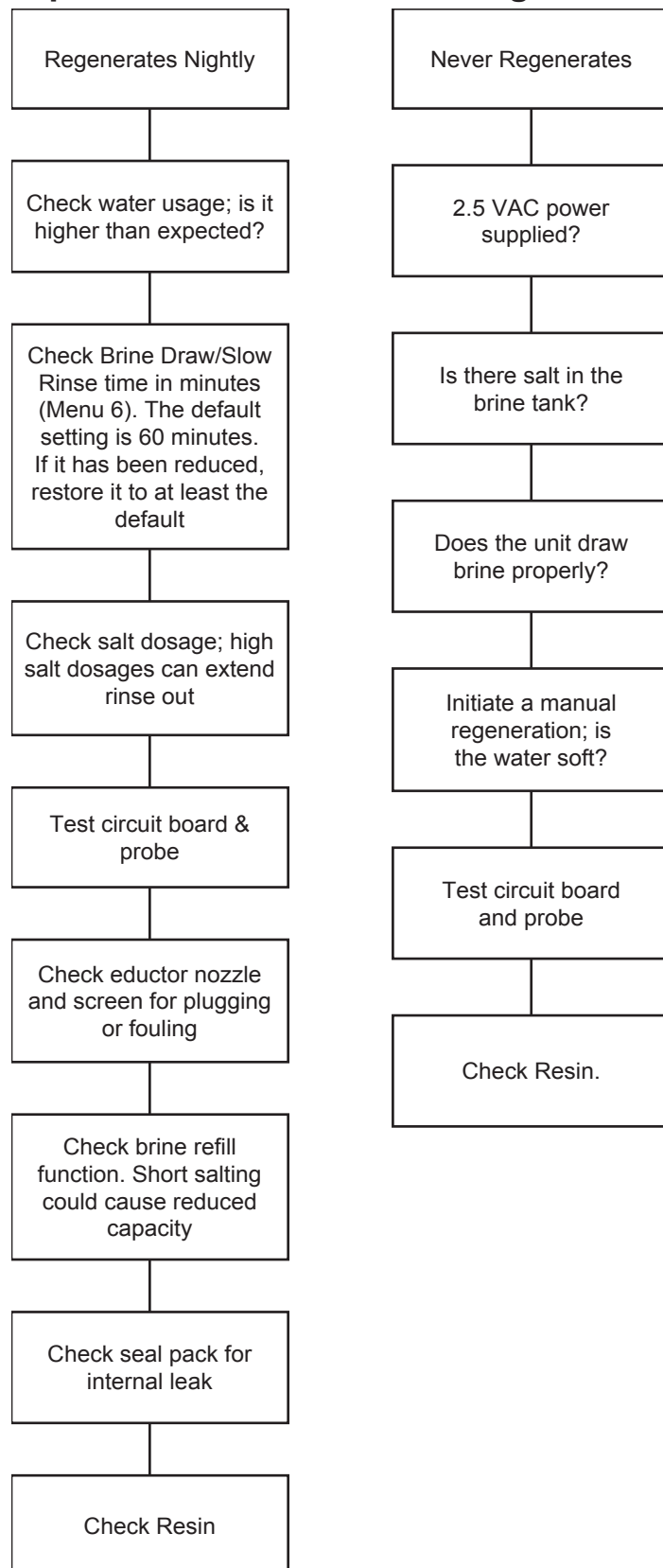
1. Submerge both cells of the probe into the resin.
2. Go to the Zratio information screen (Main Menu—>Diagnostics—>Check Sensors).
3. Allow the Zratio to stabilize and then write down what is displayed on the screen. The number should be between 0.900 and 1.300 for regenerated resin.
4. Pull the upper cell out of the resin and allow the Zratio to stabilize. The Zratio should be higher by at least 10 percent from the previous reading. Ignore the Zmin and %Increase information; Zmin is set only after a successful regeneration, and %Increase compares the current Zratio to Zmin.

Resin and Regeneration

If the circuit board and the probe pass all tests, the condition of the resin or the regeneration process may actually be to blame.

1. While the probe is out of the tank, take a sample of resin and examine it for breakage (fines) and fouling.
2. Remove the power to the control.
3. Return the probe to the tank and reconnect it to the circuit board.
4. Power up the control and verify that the program matches the settings recorded at the beginning of the procedure. Also, make sure that the settings are correct for the application. It is recommended that the brine rinse time be left at the time calculated by the microprocessor automatically (increases for higher salt dosages or low inlet pressure conditions) to assure adequate rinse time. The Automatic Rinse Time feature will shorten the actual rinse time as it detects the passage of the salt from the tank. Setting the time at too short a value could prevent complete rinse-out and cause daily regeneration.
5. Backwash the unit for 2–3 minutes after installing the probe to eliminate any air pockets in the unit.
6. Check the unit for regeneration function (salt dosage, brine draw, rinse and refill).

Aqua-Sensor® Troubleshooting Flowchart














Diagnostics










There are a large number of diagnostic menu screens to aid in setup and troubleshooting of the HE 1.5 Twin system, including the following diagnostic menus:

1. Advanced Statistics
2. Check Sensors
3. Test Wireless Remote
4. Test Progressive Flow
5. Motor Control
6. Auxiliary Output Statistics
7. Auxiliary Output Test
8. Use Data Port
9. Test Phone Line








Advanced Statistics














Flow Statistics

Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
3)SET DATE/TIME 4)ACCESSORIES 5)ADV. SETUP >6)DIAGNOSTICS	1-6	2. The screen displays the main menu. Press       to select 6)DIAGNOSTICS.
>1)ADVANCED STAT 2)CHECK SENSORS 3)TEST WIRELESS 4)TEST PROGFLOW	1-9	3. The screen displays the diagnostics menu. Press  to select 1)ADVANCED STAT.
>1)FLOW STATS 2)REGEN STATS 3)TANK STATS 4)FW VERSION	1-6	4. The screen displays the advanced statistics menu. Press  to select 1)FLOW STATS.
TOTALIZED FLOW 50000 GALLONS		5. The screen displays the TOTALIZED FLOW in gallons since the unit was installed. Press  to display the next statistic.
CURRENT FLOWRATE 6.7 GPM		6. The screen displays the CURRENT FLOWRATE in gallons per minute since the unit was installed. Press  to display the next statistic.


















Screen Display	Range	Procedure
FLOW PROFILE R1 30 MINUTES		7. The screen displays the R1 FLOW PROFILE in minutes. This is the amount of time the unit spends within different flow ranges (see page 65). R1 is the amount of time that flow was below the low flow limit. Press  to display the next statistic.
FLOW PROFILE R2 50 MINUTES		8. The screen displays the R2 FLOW PROFILE in minutes. R2 is the amount of time that flow was between the LOW FLOW LIMIT and approximately 25 percent of the HIGH FLOW LIMIT . Press  to display the next statistic.
FLOW PROFILE R3 90 MINUTES		9. The screen displays the R3 FLOW PROFILE in minutes. R3 is the amount of time that flow was between approximately 25 percent of the HIGH FLOW LIMIT and approximately 50 percent of the HIGH FLOW LIMIT . Press  to display the next statistic.
FLOW PROFILE R4 100 MINUTES		10. The screen displays the R4 FLOW PROFILE in minutes. R4 is the amount of time that flow was between 50 and 75 percent of the HIGH FLOW LIMIT . Press  to display the next statistic.
FLOW PROFILE R5 5 MINUTES		11. The screen displays the R5 FLOW PROFILE in minutes. R5 is the amount of time that flow was between approximately 75 percent of the HIGH FLOW LIMIT and the HIGH FLOW LIMIT . Press  to display the next statistic.
FLOW PROFILE R6 5 MINUTES		12. The screen displays the R6 FLOW PROFILE in minutes. R6 is the amount of time that flow was above the HIGH FLOW LIMIT . Press  to return to the advanced statistics menu.
SOFTENING JAN-01-12 12:01P		13. Press    to save the settings and display the home screen.

Regeneration Statistics

















Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
3)SET DATE/TIME 4)ACCESSORIES 5)ADV. SETUP >6)DIAGNOSTICS	1-6	2. The screen displays the main menu. Press       to select 6)DIAGNOSTICS .

Screen Display	Range	Procedure
>1)ADVANCED STAT 2)CHECK SENSORS 3)TEST WIRELESS 4)TEST PROGFLOW	1–9	3. The screen displays the diagnostics menu. Press  to select 1)ADVANCED STAT .
1)FLOW STATS >2)REGEN STATS 3)TANK STATS 4)FW VERSION	1–6	4. The screen displays the advanced statistics menu. Press   to select 2)REGEN STATS .
TOTAL REGENS 100		5. The screen displays the TOTALIZED REGENERATIONS since the unit was installed. Press  to display the next statistic.
REGENS IN LAST 14 DAYS: 5		6. The screen displays the number of regenerations in the past 14 days. Press  to display the next statistic.
DAYS SINCE LAST REGEN: 1		7. The screen displays the number of days since the last regeneration. Press  to display the next statistic.
LAST REGEN ON JAN–01	Jan–Dec 01–31	8. The screen displays the date of the last regeneration of the unit (in this example, January 1, 2010). Press  to display the next statistic.
LAST REGEN TRIG Manual	Manual, Meter, Aqua-Sensor, (Day), Aux Input, Power Outage	9. The screen displays the device that triggered the last regeneration. Press  to display the next statistic.
LAST BD/SR TIME 57 MINUTES		10. The screen displays the time elapsed, in minutes, since the last pause. This is helpful when diagnosing external accessories. Press  to display the next statistic.
LAST FILL TIME 420 SECONDS		11. The screen displays the time elapsed since the last fill time of the unit, in seconds. Press  to return to the advanced statistics menu.
SOFTENING JAN–01–12 12:01P		12. Press    to save the settings and display the home screen.








Tank Statistics











Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
3)SET DATE/TIME 4)ACCESSORIES 5)ADV. SETUP >6)DIAGNOSTICS	1-6	2. The screen displays the main menu. Press       to select 6)DIAGNOSTICS .
>1)ADVANCED STAT 2)CHECK SENSORS 3)TEST WIRELESS 4)TEST PROGFLOW	1-9	3. The screen displays the diagnostics menu. Press  to select 1)ADVANCED STAT .
1)FLOW STATS 2)REGEN STATS >3)TANK STATS 4)FW VERSION	1-6	4. The screen displays the advanced statistics menu. Press    to select 3)TANK STATS .
REMAIN CAPACITY 700 GALLONS		5. The screen displays the remaining capacity of the unit, in gallons, before the regeneration signal is triggered. Press  to display the next statistic.
TOTAL CAPACITY 1000 GALLONS		6. The screen displays the total capacity of the unit, in gallons. Press  to display the next statistic.
TOTAL WATER USED 10000 GALLONS		7. The screen displays the total water used by the unit since it was installed. Press  to return to the advanced statistics menu.
SOFTENING JAN-01-12 12:01P		8. Press    to save the settings and display the home screen.

Firmware Version















Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
3)SET DATE/TIME 4)ACCESSORIES 5)ADV. SETUP >6)DIAGNOSTICS	1-6	2. The screen displays the main menu. Press       to select 6)DIAGNOSTICS .
>1)ADVANCED STAT 2)CHECK SENSORS 3)TEST WIRELESS 4)TEST PROGFLOW	1-9	3. The screen displays the diagnostics menu. Press  to select 1)ADVANCED STAT .
3)TANK STATS >4)FW VERSION 5)SERIAL NUMBER 6)LAST POWER UP	1-6	4. The screen displays the advanced statistics menu. Press     to select 4)FW VERSION .
FWR217LT01 Jul 24 2012		5. The screen displays the latest firmware version of the Smart Controller circuit board. Press  to return to the advanced statistics menu.
SOFTENING JAN-01-12 12:01P		6. Press    to save the settings and display the home screen.





Serial Number

Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
3)SET DATE/TIME 4)ACCESSORIES 5)ADV. SETUP >6)DIAGNOSTICS	1-6	2. The screen displays the main menu. Press       to select 6)DIAGNOSTICS .













Screen Display	Range	Procedure
>1)ADVANCED STAT 2)CHECK SENSORS 3)TEST WIRELESS 4)TEST PROGFLOW	1-9	3. The screen displays the diagnostics menu. Press  to select 1)ADVANCED STAT .
3)TANK STATS 4)FW VERSION >5)SERIAL NUMBER 6)LAST POWER UP	1-6	4. The screen displays the advanced statistics menu. Press      to select 5)SERIAL NUMBER .
S/N:00025526		5. The screen displays the serial number of the unit controller circuit board. Press  to return to the advanced statistics menu.
SOFTENING JAN-01-12 12:01P		6. Press    to save the settings and display the home screen.







Last Power Up

Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
3)SET DATE/TIME 4)ACCESSORIES 5)ADV. SETUP >6)DIAGNOSTICS	1-6	2. The screen displays the main menu. Press       to select 6)DIAGNOSTICS .
>1)ADVANCED STAT 2)CHECK SENSORS 3)TEST WIRELESS 4)TEST PROGFLOW	1-9	3. The screen displays the diagnostics menu. Press  to select 1)ADVANCED STAT .
3)TANK STATS 4)FW VERSION 5)SERIAL NUMBER >6)LAST POWER UP	1-6	4. The screen displays the advanced statistics menu. Press       to select 6)LAST POWER UP .

Screen Display	Range	Procedure
LAST POWER UP JAN-01-12 11:02A		5. The screen displays the date and time when the unit was last powered on. This can be helpful if there was a power outage to see how long the unit has been powered on. Press  to return to the advanced statistics menu.
SOFTENING JAN-01-12 12:01P		6. Press    to save the settings and display the home screen.

Check Sensors

Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
3)SET DATE/TIME 4)ACCESSORIES 5)ADV. SETUP >6)DIAGNOSTICS	1-6	2. The screen displays the main menu. Press       to select 6)DIAGNOSTICS .
1)ADVANCED STAT >2)CHECK SENSORS 3)TEST WIRELESS 4)TEST PROGFLOW	1-9	3. The screen displays the diagnostics menu. Press   to select 2)CHECK SENSORS .
MAIN BOARD POSITION SENSOR HOME:OFF POS:OFF	Light No Light	4. The screen displays the status of the optical sensor. There is NO LIGHT when the control is in a cycle position. The screen displays LIGHT when the control is changing cycle (motor moving). Press  to display the next sensor.
FLOW METER 0 PULS/SEC		5. The screen displays the current pulses per second of the flow meter. Press  to display the next sensor.
AQUASENSOR SUPPLY VOLTAGE 2.5VAC: PASS SIM TEST: FAIL	Not Installed, Pass, Fail	6. The screen displays the Aqua-Sensor supply voltage. The status is PASS when the circuit board detects 2.5VAC connected to the board. The status is FAIL when the 2.5VAC is either not connected to the circuit board or the transformer is defective. Press  to display the next sensor.

Screen Display	Range	Procedure
AQUASENSOR Zratio 429496 Zminimum 0.000 00.0% Increase		<p>7. The screen displays the Aqua-Sensor troubleshooting statistics.</p> <ul style="list-style-type: none"> • Z-Ratio (impedance ratio)—Number calculated by micro-processor on measured voltage values that are converted to a digital representation. This is the value that the control monitors in order to determine need for regeneration and salt rinse-out. • Z-Minimum (minimum impedance ratio)—Reference point that the Z-ratio is compared to, in order to initiate a regeneration. This number is reset after every successful regeneration. • Z-Increase Percent (impedance ratio increase)—During service, this number represents the percent increase or z-ratio over z-minimum. A regeneration is initiated when it reaches 7.5% or more for at least 6 minutes. <p>See page 83 for additional information on Aqua-Sensor troubleshooting. Press  to display the next sensor.</p>
SBT SENSOR Salometer=OP Salt Level=OP FR1=OP FR2=OP	BL, OP	<p>8. The screen displays the Smart Brine Tank probe troubleshooting statistics. The SBT probe has four sensors within it. The Check sensor screen displays the current status (opened = "OP", or blocked = "BL") for all four sensors. The expected outputs from the SBT probe inside the brine tank are shown in Table 10 while the expected outputs from an SBT probe "in air" are shown in Table 11. Press  to display the next sensor.</p>
SBT AVG T3 0 SECONDS		<p>9. The screen displays additional Smart Brine Tank probe troubleshooting statistics. In addition to the four sensors, the SBT probe takes a measurement during each regeneration cycle called T3. This measurement varies from system to system, but is typically between 30 and 120 seconds for a residential system. When the SBT is turned from UNINSTALLED to INSTALLED on the Accessories menu, the baseline value of T3 is erased and the system will use the next three regeneration cycles to compute a new T3 baseline number. Press  to display the next sensor.</p>
SBT Last T3 30 SECONDS		<p>10. The screen displays additional Smart Brine Tank probe troubleshooting statistics. During each subsequent regeneration, the new T3 is compared to the baseline T3 number. If the new T3 exceeds the baseline T3 by more than 30% then the system will display a "Brine Line Blockage – Check Brine Line" error message. The baseline T3 value is displayed on the diagnostic screen after the SBT sensor screen. Press  to return to the advanced statistics menu.</p>
SOFTENING JAN-01-12 12:01P		<p>11. Press   to display the home screen.</p>














	Displays BL	Displays OP
Salometer	Brine at least 1 inch above the salt plate.	Salt level is less than 1" above the salt plate
Salt Level	Salt level less than 8" above the salt plate	Normal Operation. Salt level greater than 8" above the salt plate
Flow Rate #1	Water level in brine tank is below salt plate	Water level in brine tank is more than 1" above salt plate
Flow Rate #2	Water level in brine tank is more than 1" above salt plate	Water level in brine tank is below salt plate

Table 10. Expected Readings on the Sensor/Diagnostic screen when the SBT probe is installed inside the brine tank.















	Normally	Probe Inverted
Salometer	OP	BL
Flow Rate #1	BL	OP
Flow Rate #2	OP	BL

Table 11. Expected Readings from the SBT probe when the probe is sitting in air (not installed in the brine tank).













Test Wireless, Progressive Flow, and Motor Control




Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
3)SET DATE/TIME 4)ACCESSORIES 5)ADV. SETUP >6)DIAGNOSTICS	1-6	2. The screen displays the main menu. Press       to select 6)DIAGNOSTICS .
1)ADVANCED STAT 2)CHECK SENSORS >3)TEST WIRELESS 4)TEST PROGFLOW	1-9	3. The screen displays the diagnostics menu. Press    to select 3)TEST WIRELESS .
WIRELESS TEST 0 / 14	1-no limit	4. The screen displays the wireless test diagnostic. Press  to test the signal strength.
WIRELESS TEST 0 / 269 RSSI=5	0-5	5. The screen displays the number of connection attempts and the radio signal strength index. If the screen displays RSSI = 0, there is no wireless signal.
SOFTENING JAN-01-12 12:01P		6. Press   to return to the home screen.

Test Progressive Flow
















Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
3)SET DATE/TIME 4)ACCESSORIES 5)ADV. SETUP >6)DIAGNOSTICS	1-6	2. The screen displays the main menu. Press       to select 6)DIAGNOSTICS .
2)CHECK SENSORS 3)TEST WIRELESS >4)TEST PROGFLOW 4)TEST PROGFL	1-9	3. The screen displays the diagnostics menu. Press     to select 4)TEST PROGFLOW .
PROGRESSIVE TEST 1:000, 2:000 3:000, 4:000 5:000 Tx:0000	0-5	4. The screen displays the progressive flow test diagnostic that shows the data packet transmissions from the master (Tx) and which slaves are receiving (1, 2, 3, 4, and/or 5). Press  to view the next progressive flow screen. 5. For example, in a triplex system, if the transmission from the master (Tx) is 1252, then you should see 1:1252 and 2:1252. 3, 4, and 5 will remain all zeros because no other slaves are connected.
SOFTENING JAN-01-12 12:01P		6. Press   to return to the home screen.

Motor Control Diagnostic




















Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
3)SET DATE/TIME 4)ACCESSORIES 5)ADV. SETUP >6)DIAGNOSTICS	1-6	2. The screen displays the main menu. Press       to select 6)DIAGNOSTICS .
2)CHECK SENSORS 3)TEST WIRELESS 4)TEST PROGFLOW >5)MOTOR CONTROL	1-9	3. The screen displays the diagnostics menu. Press      to select 5)MOTOR CONTROL .

Screen Display	Range	Procedure
MOTOR AT POS 1 UP:FWD DWN:REV	1–6	4. The screen displays the position of the motor. Press  to change the motor position. See “Manual Cycling” on page 70 for more information.
BACKWASH MIN LEFT NEXT CYCLE	Next Cycle, End Regen Now, End/Cancel Trig	5. If cycling the control during regeneration, the screen displays the regeneration setting. See “Manual Regeneration” on page 68 for more information.
SOFTENING JAN-01-12 12:01P		6. Press   to return to the home screen.


















Aux Out Status

Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
3)SET DATE/TIME 4)ACCESSORIES 5)ADV. SETUP >6)DIAGNOSTICS	1–6	2. The screen displays the main menu. Press       to select 6)DIAGNOSTICS .
3)TEST WIRELESS 4)TEST PROGFLOW 5)MOTOR CONTROL >6)AUX OUT STAT	1–9	3. The screen displays the diagnostics menu. Press       to select 6)AUX OUT STAT .
AUX OUT STATUS 1:ON 2:OFF 3:OFF 4:OFF 5:OFF	On, Off 1–5	4. The screen displays the status of each of the controller’s AUX Outputs. For example, the screen displays 1:ON . This indicates that AUX 1 is currently on.
SOFTENING JAN-01-12 12:01P		5. Press   to return to the home screen.








Aux Out Test












Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
3)SET DATE/TIME 4)ACCESSORIES 5)ADV. SETUP >6)DIAGNOSTICS	1-6	2. The screen displays the main menu. Press       to select 6)DIAGNOSTICS .
4)TEST PROGFLOW 5)MOTOR CONTROL 6)AUX OUT STAT >7)AUX OUT TEST	1-9	3. The screen displays the diagnostics menu. Press        to select 7)AUX OUT TEST .
AUX OUT TEST AUX 1 ON Press Enter...	1-5	4. The AUX OUT TEST test each of the Aux Out switches. For example, the screen displays AUX 1 ON. This indicates that AUX 1 is currently off and if you press enter () the state changes to AUX 1 ON. Press  to turn cycle through all available outputs.
AUX OUT TEST COMPLETE Press Enter...		5. After the last output, the screen displays COMPLETE. Press  to return the outputs to their previous status; the screen displays the Diagnostics menu.
SOFTENING JAN-01-12 12:01P		6. Press   to return to the home screen.

Use Data Port

Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
3)SET DATE/TIME 4)ACCESSORIES 5)ADV. SETUP >6)DIAGNOSTICS	1-6	2. The screen displays the main menu. Press       to select 6)DIAGNOSTICS .
5)MOTOR CONTROL 6)AUX OUT STAT 7)AUX OUT TEST >8)USE DATA PORT	1-9	1. From the diagnostics menu, press         to select 8)USE DATA PORT .
Mini Report: Sending...		2. The controller will attempt to send a mini-report to the data port.
Mini Report: Sent...		3. The screen indicates when the report has been sent to the data port. If nothing is attached to the data port, the screen displays a busy message. See page 137 for data port output information.
SOFTENING JAN-01-12 12:01P		4. Press   to return to the home screen.

Test Phone Line

Screen Display	Range	Procedure
SOFTENING JAN-01-12 12:01P	N/A	1. From the HOME screen, press  to view the main menu.
3)SET DATE/TIME 4)ACCESSORIES 5)ADV. SETUP >6)DIAGNOSTICS	1-6	2. The screen displays the main menu. Press       to select 6)DIAGNOSTICS .

Screen Display	Range	Procedure
6)AUX OUT STAT 7)AUX OUT TEST 8)USE DATA PORT >9)TEST PHONELIN	1-9	3. The screen displays the diagnostics menu. Press          to select 9)TEST PHONELIN . The screen displays the modem test.
MODEM TEST Emailing now Please Wait...		4. The unit sends a test message through the telemetry system.
MODEM EMAIL SUCCESS		5. The unit reports a reason code, displayed as "REASON CODE: 1." See page 60 for phone line test information.
SOFTENING JAN-01-12 12:01P		6. Press   to return to the home screen.

Maintenance

Familiarize yourself with the replacement procedures and component parts thoroughly before attempting any repair.



WARNING! Disconnect all electrical power to the unit before servicing. Bypass the unit and relieve system pressure before attempting repair.

Circuit Board

1. Remove the electrical enclosure from the control valve. Remove the electrical enclosure screw, and then gently remove the enclosure from the control. See Figure 55.

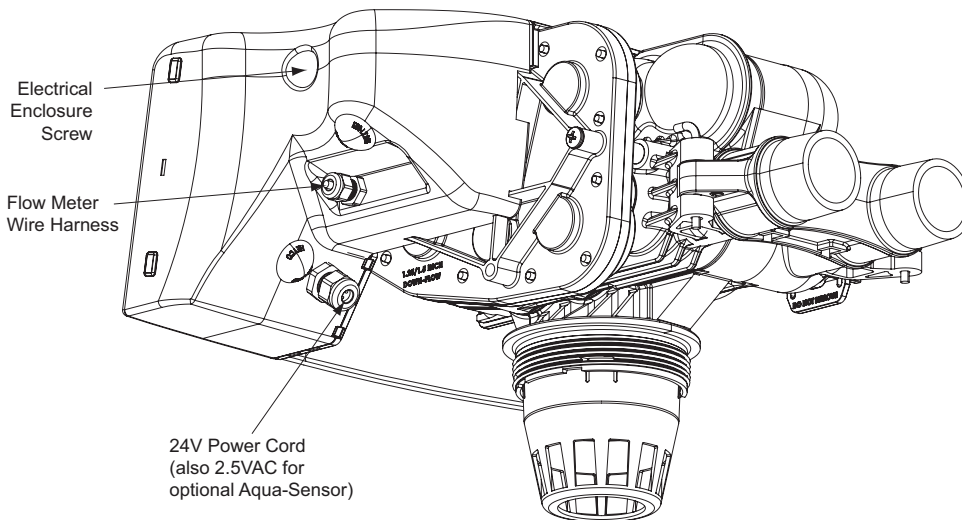


Figure 55. Electrical and accessory connections.

2. Remove the 24V power supply wire harness and flow meter connectors from the circuit board. See Figure 56.
3. Grip the circuit board from the edges and gently rotate it to the back of the enclosure (disengage the circuit board from the two support pins on the bottom of the enclosure). See Figure 57.

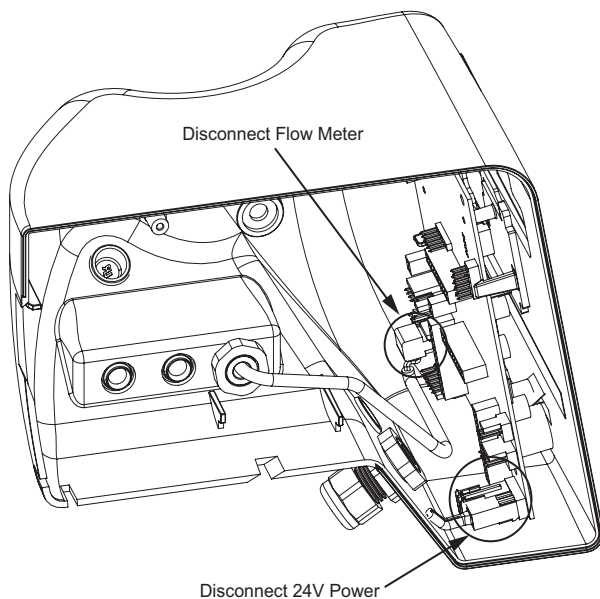


Figure 56. Remove flow meter and 24V connections.

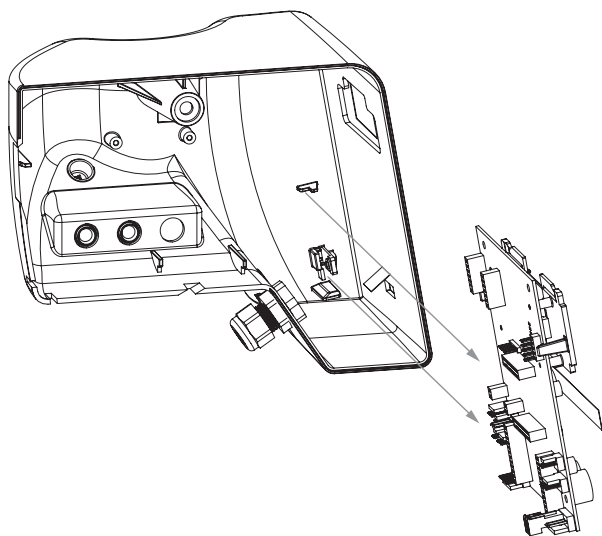


Figure 57. Remove circuit board.

4. Remove the circuit board from the enclosure.
5. Remove all connected wires from the board.
6. To install a new circuit board, follow steps 1–5 in reverse order.
7. Reprogram the circuit board.



CAUTION! Do not touch any surfaces of the circuit board. Electrical static discharges may cause damage to the board. Handle the AccuSoft™ circuit board by holding only the edges of the circuit board. Keep replacement boards in their special anti-static bags until ready for use. Mishandling of the circuit board will void the warranty.



CAUTION! Properly connect the wire connectors to the circuit board. The wires must exit the plug-in connector opposite of the raised white base of the circuit board connector.



CAUTION! Take extra care when connecting the 2.5 VAC and 24V power. Failure to connect properly will result in damage to the circuit board.

Drive Motor

1. Disconnect the two motor power wires from the motor—note that the black wire is placed in the bottom position.
2. Slide the compartment plate away from the gear motor and the control valve frame.
3. Disconnect the position sensor from the gearbox.
4. Remove the motor retainer rod by squeezing the snap release end of the rod. See Figure 58.
5. Firmly pull the motor straight outward. It may be necessary to gently tap on the motor body to get the motor to release.
6. In order to insert the new motor into the gearbox, it is necessary to get the “flat” on the motor shaft to line up with the “flat” in the gearbox drive-gear. The easiest way to do this is to hold the motor in position, attempting to push it into the drive gear, while causing the motor shaft to turn by using the Advanced Setup\Diagnostics\ Manual Motor Control menu. (Alternatively, if you remove water pressure from the valve, and/or remove the gearbox from the valve body, you can turn insert a large screw driver into the drive gear and use the screw-driver to rotate the drive gear so that the flat on the drive gear lines up with the flat on the motor shaft.)
7. Once the motor is fully inserted, re-install the motor retainer rod, compartment plate, and motor wire harness.

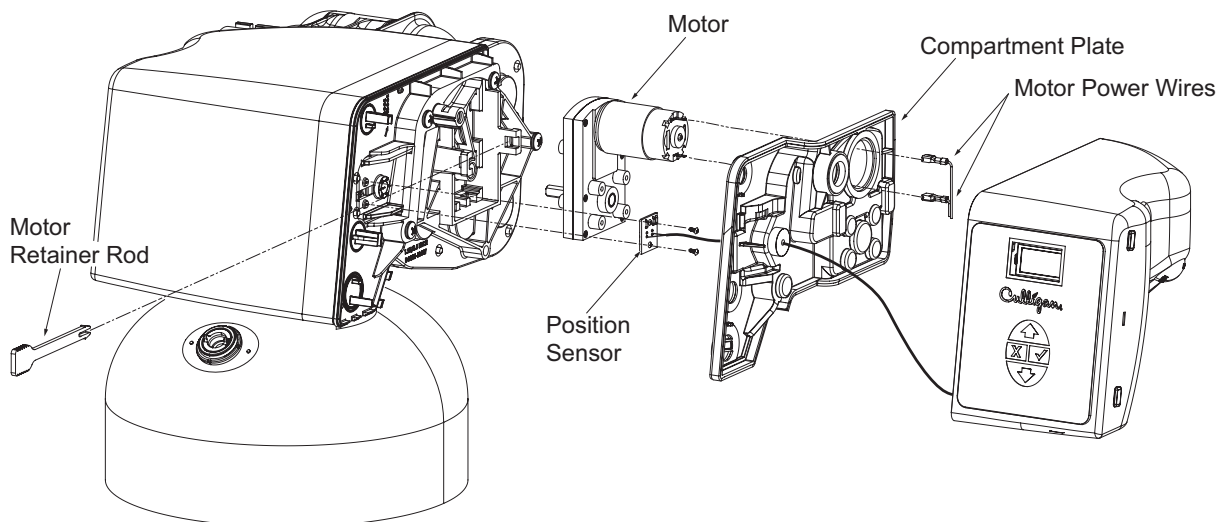


Figure 58. HE 1.5 drive motor.

Replace the Gearbox

1. Remove the HE 1.5 electrical enclosure. See the circuit board replacement instructions to remove the electrical enclosure.
2. Remove water pressure (put the manual bypass valve to BYPASS and then use manual motor control to position the valve in the bypass position).
3. Disconnect the motor power wires.
4. Remove the compartment plate.
5. Remove the position sensor from the gearbox by removing the two small Phillips head screws on the optical sensor board.
6. Remove the four large Phillips head screws which attach the gearbox to the valve body. See Figure 59.
7. Install the new gearbox by reversing the directions listed above. Take care to make sure that the four large Phillips screws are fully inserted and tight.

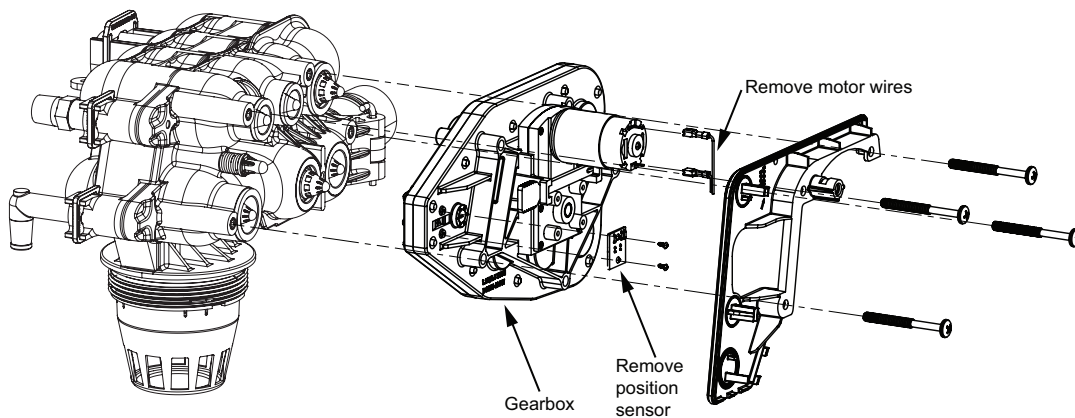


Figure 59. HE 1.5 gearbox.

Replace the Pistons

1. Remove the HE 1.5 electrical enclosure. See the circuit board replacement instructions to remove the electrical enclosure.
2. Follow the directions to "Replace the Gearbox"
3. Using fingers or pliers pull the six pistons out of the valve body. Also remove the brine piston. See Figure 60.
4. There is a spring snap-fit onto the bottom of each of the six main pistons. You can remove these springs and re-use them by snapping them onto the bottom of a new piston. When attaching a spring to the piston, take care to orient the spring so that the spring and piston are aligned and straight. If after assembly the two components are not straight, un-snap the spring, rotate it 180 degrees and re-snap it; it should now be straight.
5. Replace the gearbox following the remaining steps listed under "Replace the Gearbox."

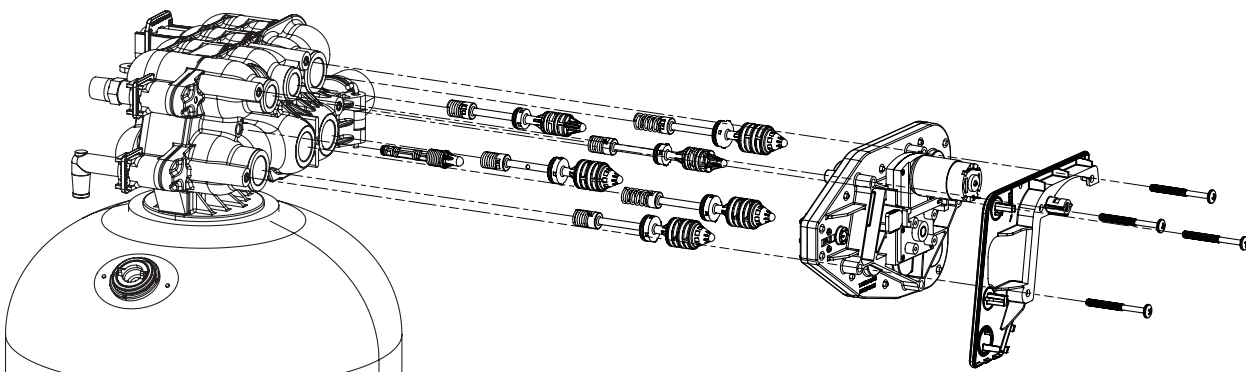


Figure 60. Pistons.

Inspect/Clean/Replace the Eductor

1. Remove water pressure from the valve.
2. Remove the plastic clip from the upper service port opening (this port is located on the side of the valve body, just above the eductor plug). See Figure 61.
3. Remove the eductor plug retainer rod.
4. Remove the eductor cap.
5. Use the notched end of the retainer rod to extract the eductor assembly from the valve body. Use moderate pulling force to overcome the O-ring resistance.
6. Unscrew the eductor filter from the eductor body.

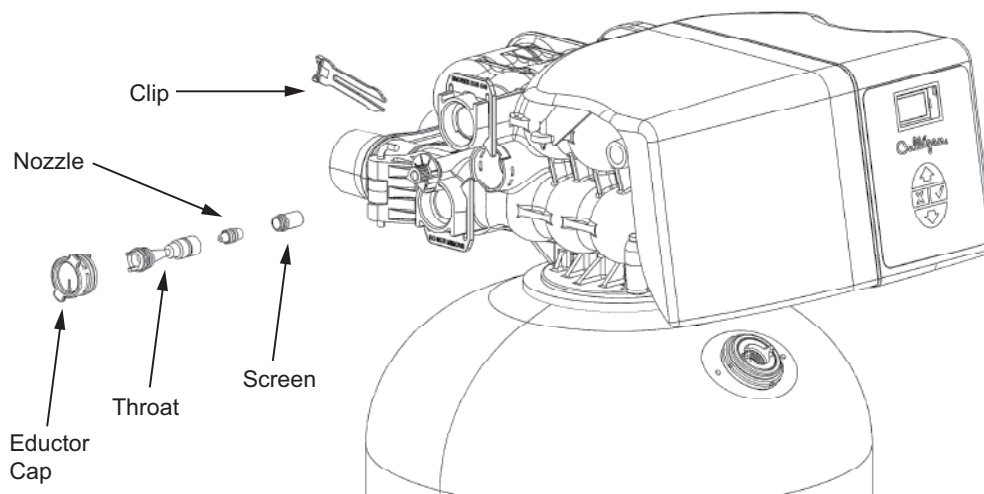


Figure 61. Removing the eductor nozzle and throat.

7. Use a small screw driver to extract the eductor nozzle from inside the eductor body.
8. Re-assemble the valve by reversing these instructions. Take care when re-inserting the eductor cap – there is an arrow molded into the eductor cap. If the cap is installed with the arrow pointing “UP” then the valve is configured for Upflow brining. If the arrow is pointing “DOWN” then the valve is configured for Downflow brining.

Inspect/Clean the Brine Line and Backwash Flow Control

1. Relieve water pressure from the valve.
2. Remove the cover by releasing the cover fastener from the control (see Figure 12 on page 15).
3. Remove the snap clip which retains the brine line adapter and drain line. (Note that it is easier to do this if you first remove the wing-screws that retain the HE electronics enclosure.) See Figure 62.
4. Remove the brine line adapter and drain connector.
5. Unscrew the brine line filter from the inner end of the brine line adapter and drain line flow control from the drain connector.
6. Reassemble by reversing the directions above.

NOTE The number of the flow control should face into the valve body.

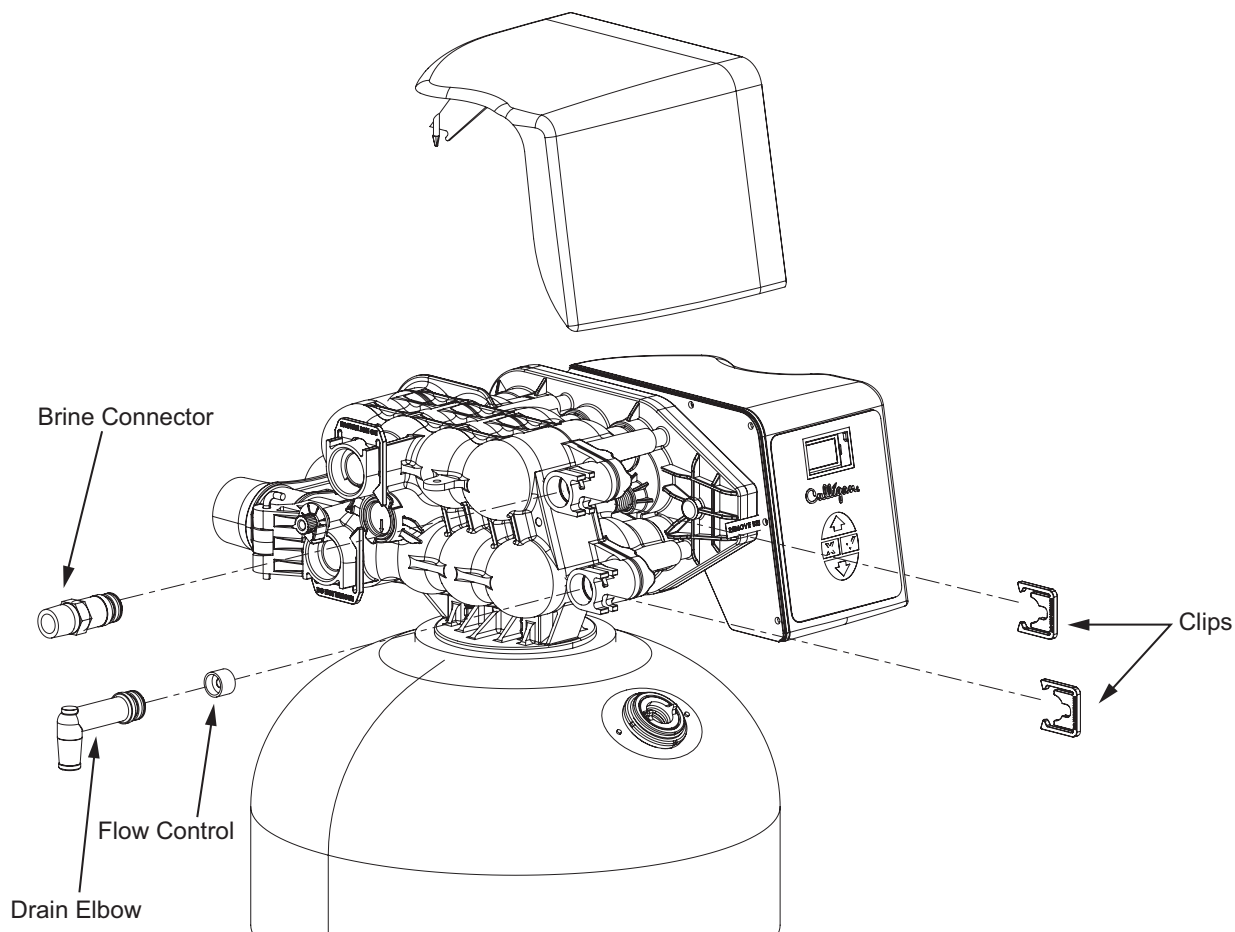


Figure 62. Brine line.

Backwash Flow Controllers—Theory of Operation and Service

Located on the drain connection of the valve, the purpose of the backwash flow controller is to regulate the up flow backwash required to expand and agitate the resin in the softener. The softener will allow maximum expansion of the resin, while preventing any loss to the drain.

The flow control principle is simple and trouble free. The specified rate of flow will be constant regardless of inlet pressure variations. This is accomplished by the automatic change in orifice size of the flow washer as inlet pressure varies.

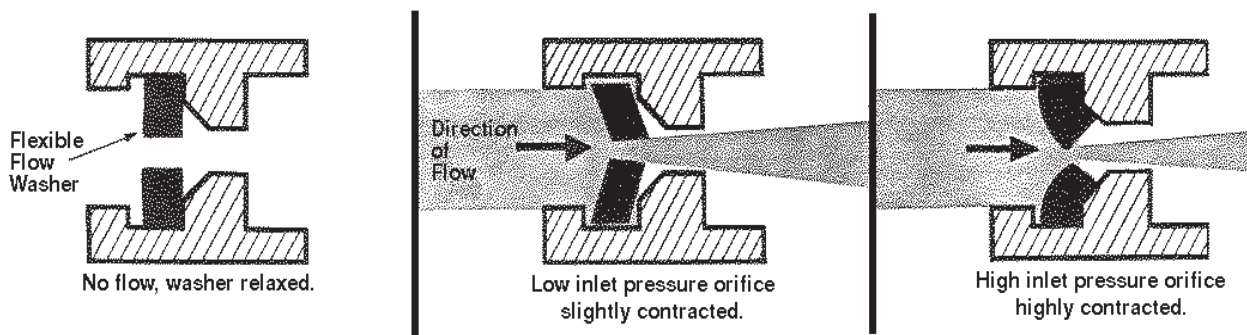


Figure 63. Backwash flow operation.

The flow washer pictured above is installed within a special nipple. Occasionally, the Backwash Flow Controller may become plugged with scale, rust, or other foreign material. If this occurs, cleaning is required. This can be done while the softener is in SERVICE and under pressure.

Depressurizing the HE 1.5 Twin Valve and System for Service

Complete shutdown procedure is as follows:

1. Make certain that the lines you shut off are for the system you are performing service on.
 - a. Open bypass valve if one is available.
 - b. Close the inlet isolation valve.
 - c. Close the outlet isolation valve.
 - d. Close the manual brine valve (If installed).
 - e. Close the separate source isolation valve if one is available.
2. Cycle the valve to the backwash position.
3. Disconnect electrical power to the system.

We suggest the use of a mild cleaning solvent and a silicone lubricant. We suggest the following brands or their equivalents:

- Solvent: Simple Green—water soluble for removing corrosion and dirt.
- Lubricant: Dow Corning #111—silicone grease.

Preventive Maintenance

Suggested Preventive Maintenance Inspection Schedule

The Culligan HE 1.5 Twin commercial water softener has been designed to provide a good, consistent service life. Routinely inspecting the system may help avoid potentially costly breakdowns related to circumstances outside of the control of the dealer and/or user.

Component	Suggested Inspection Frequency	Reason for Maintenance
Entire System	At Startup, after infrequent use (idle for one week or more) or every 3–6 months if on a private water supply.	On private supplies, the appearance of off-tastes and odors, particularly if musty or “rotten egg” (caused by harmless sulfate-reducing bacteria) may indicate a need for the system to be sanitized. See “Sanitize the System” on the following page.
Backwash Flow Controller	Every 12 months or every time service is performed on the system.	Build up of sediment, iron and/or other foreign materials (found in some water supplies but not necessarily all) could negatively affect system performance. Monitor item for normal (or unexpected) wear.
HE 1.5 Valve	Every 6–12 months or every time service is performed on the system.	Build up of sediment, iron and/or other foreign materials (found in some water supplies but not necessarily all) could negatively affect system performance. Monitor item for normal (or unexpected) wear.
Softening Media	Every 2–3 years	Chlorinated water supplies can break-down/destroy resin material. Resin material may also perform poorly if subjected to other materials (sediment, iron, alum, etc) found in some water supplies (but not necessarily all).

Table 12.

Application Problems

Many service problems are not due to equipment malfunction, but rather to misapplication or environmental conditions.

The “Performance Specifications” on page 7 provide the limits of water characteristics for the HE 1.5 water softeners. If the water characteristics fall outside these limits, additional water treatment equipment may be required, or the water characteristics should be brought inside the limits. The system flow rates and exchange capacities are also listed.

Flow Rates—the backwash, brine, and slow rinse flows should not differ from those in “High Efficiency Twin 1.5 Water Softeners—Flow Rate Data (gpm)” on page 128 by more than 15 percent.

Refill Minutes/Salt Dosage/Capacity shows the hardness removal capabilities for each unit as a function of salt dosage and refill time. Multiply the inlet hardness times the maximum daily water usage to determine the daily capacity requirement. If the hardness or water usage has increased, a higher salt dosage, more frequent regeneration, or a larger softener may be needed. See “High Efficiency 1.5 Twin Refill Minutes/Salt Dosage/Capacity” on page 129.

If there are no apparent general problems or environmental problems, refer to “Troubleshooting Guide” on page 77.

Sanitize the System

A water softener in daily use on a potable water supply generally requires no special attention other than keeping the salt tank filled. Occasionally, however, a unit may require sanitization under one of the following conditions:

- At start-up time.
- After standing idle for a week or more.
- On private supplies, the appearance of off-tastes and odors, particularly if musty or “rotten egg” (caused by harmless sulfate-reducing bacteria).

NOTE If the water supply contains iron, regenerate the softener before sanitizing to remove iron from the resin.



CAUTION! Hazard from toxic fumes! Chlorine bleach and common iron control chemicals may generate toxic fumes when mixed.

If the unit uses Culligan® Sofner-gard® or other compounds containing sodium hydrosulfate, sodium bisulfate, or any other reducing agent, disconnect the device feeding the chemical(s) and manually regenerate the unit before sanitizing.

Do not use this procedure if the softener salt contains iron control additives.

1. Remove the brine tank cover.
2. Pour directly into the brine chamber one-cup of common household bleach (5.25% sodium hypochlorite) for each cubic foot of resin in the tank.
3. Manually start recharge. Allow the unit to complete the recharge cycle automatically.

NOTE If tastes and odors return frequently, even after sanitization, a continuous chlorination system may be needed. Send a water sample to a qualified laboratory for bacterial analysis.

Analyze the System

Analyzing the problem involves three basic steps:

1. Check the system in all cycle positions.
2. Compare the data to normal operating data.
3. Determine which component may cause the problem (troubleshooting).
4. If steps 1-3 did not reveal the problem, initiate a regeneration cycle and manually cycle the valve to brine draw (#2 position). Allow the unit to complete the brine draw cycle and observe how the system reacts.

Although it may be possible to solve a specific problem simply by changing a component, analyzing the entire system can reveal additional problems which would otherwise require extra service calls. Changing parts is not the same as service.

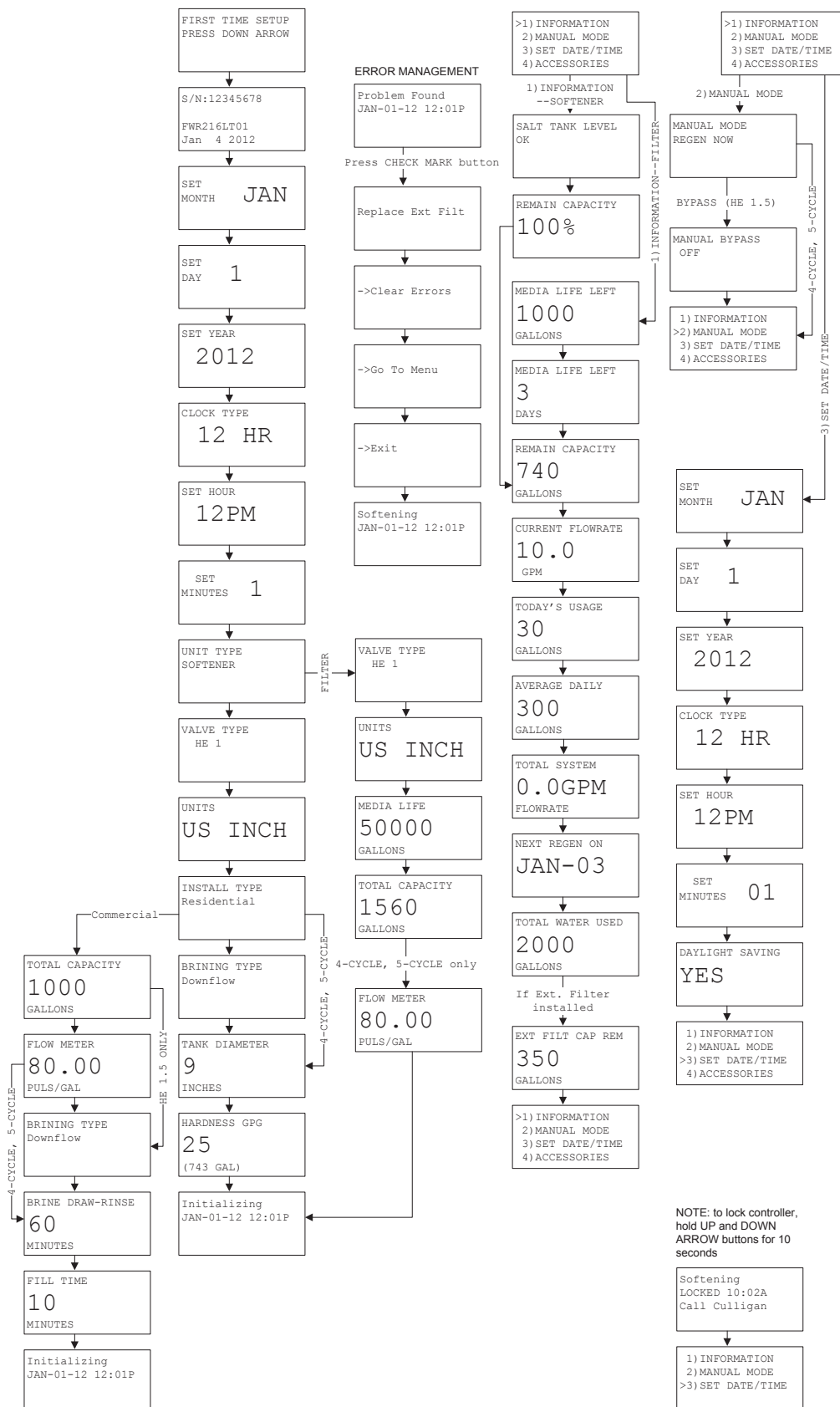
Check the System

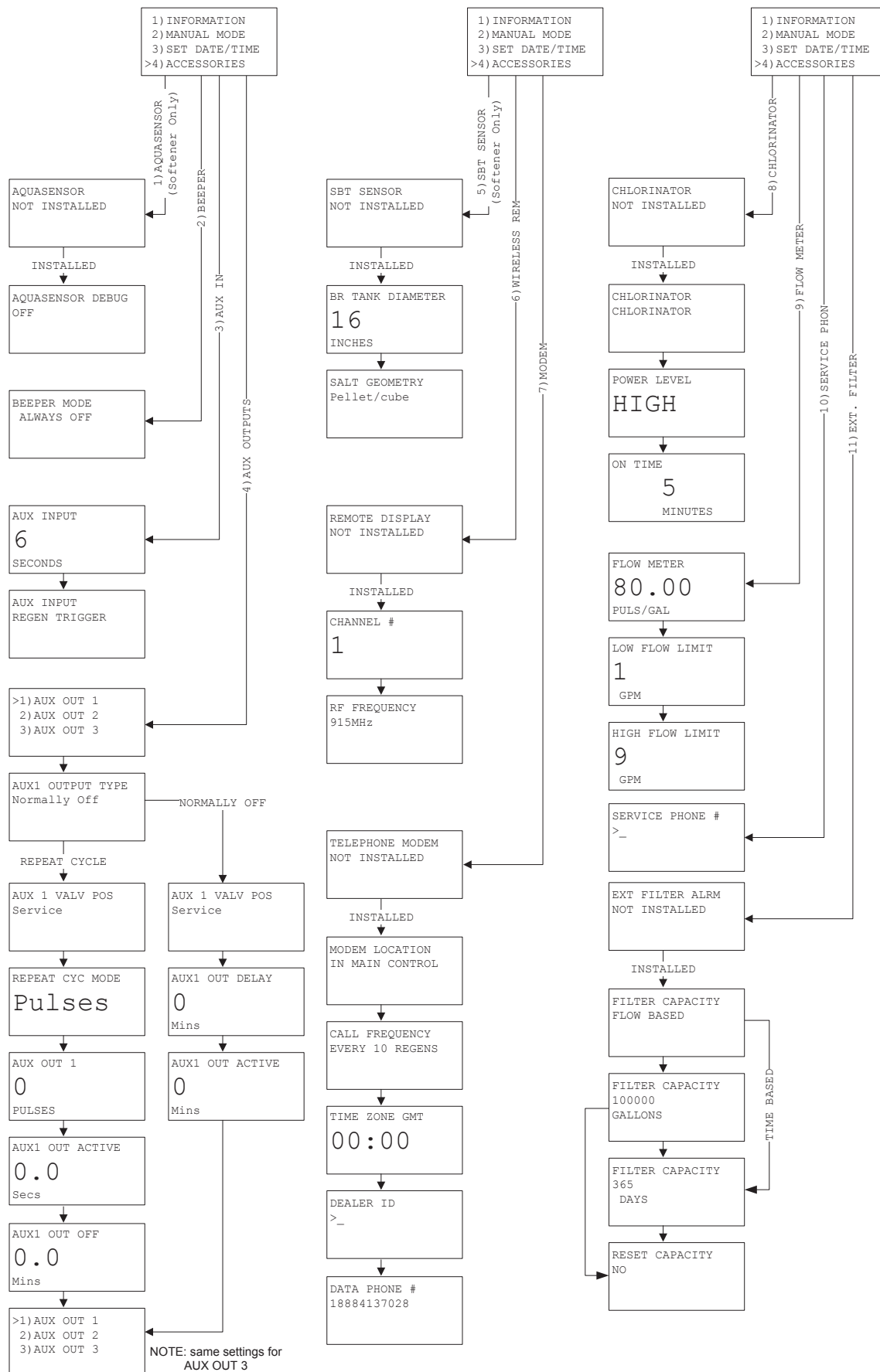
The following tools are needed to collect data:

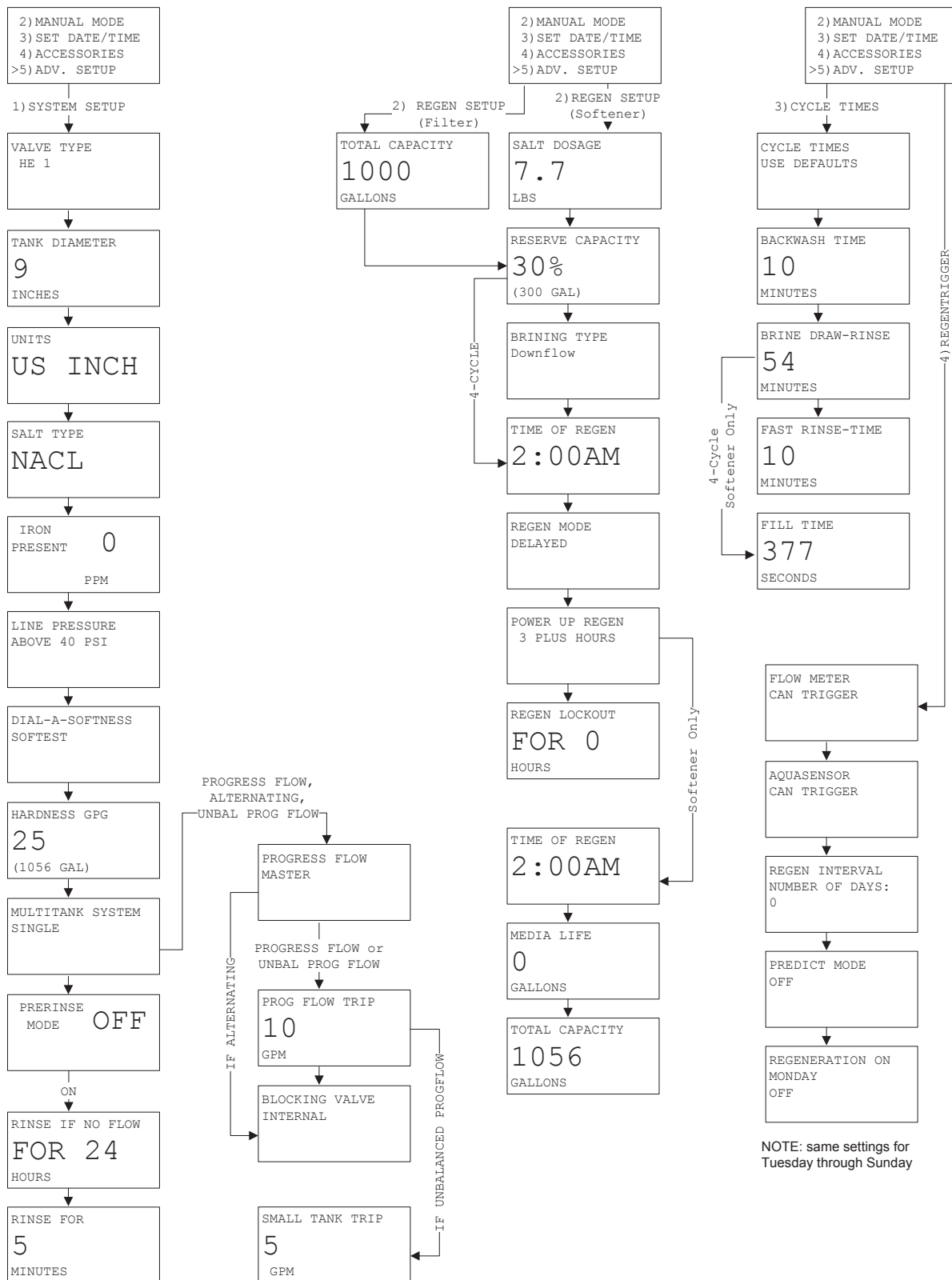
1. Hardness, iron and chlorine test kits
2. Thermometer
3. Pressure gauge, 0-120 psi
4. 5-gallon bucket and watch
5. Calculator

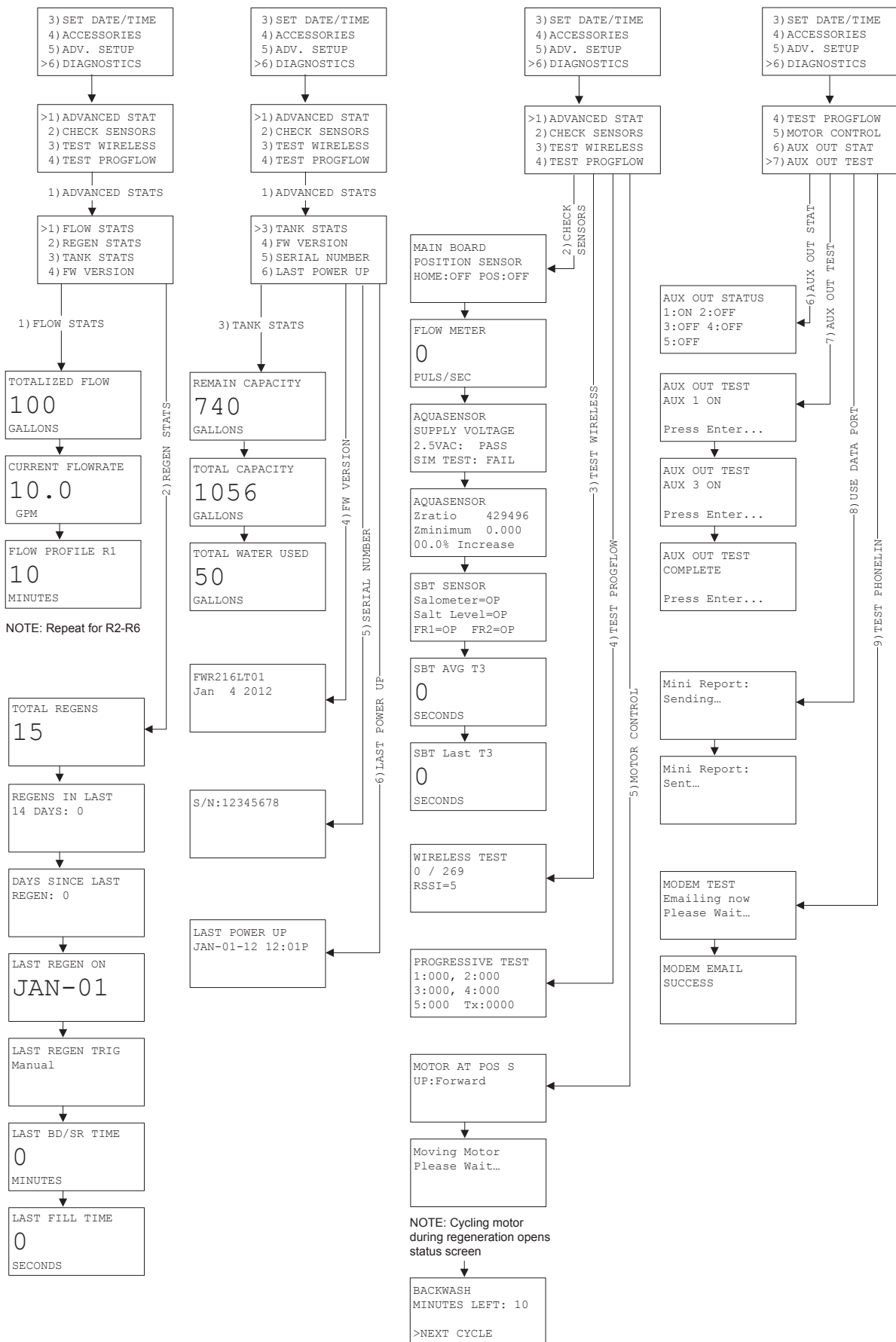
The customer can provide most data. By collecting data prior to a service call, a first guess about the cause of the problem can be made and the need for any special parts can be determined. If the problem is as simple as lack of salt in the brine tank, a service call may not be needed at all. A recommended system data sheet at the end of Appendix E “Data Port Output” on page 137 can assist the troubleshooting process.

Smart Controller Menu Overview









Remote Display Template

Remote Display Template

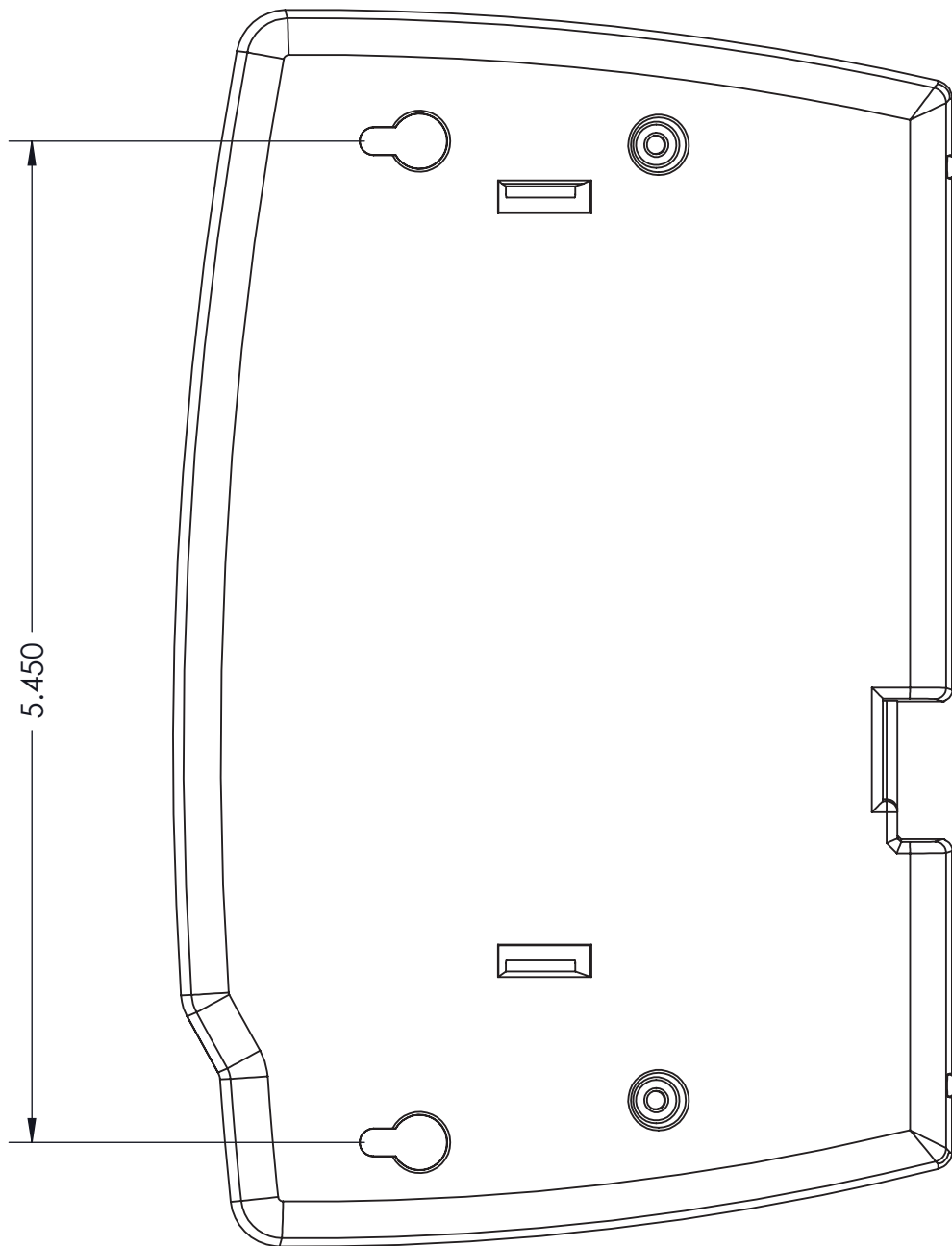


Figure 64. Hole drilling template

HE 1.5 Twin Service Parts

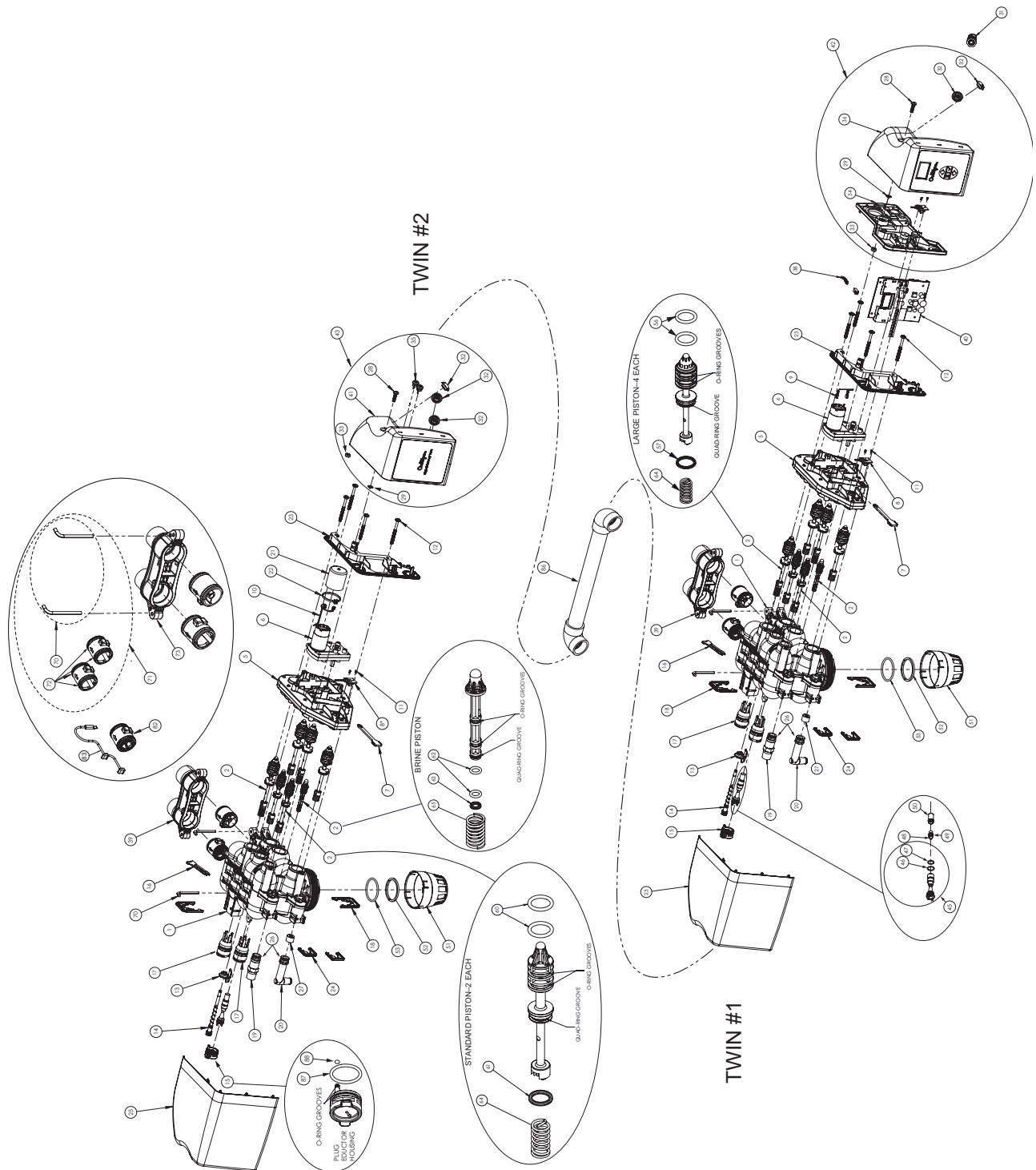


Figure 65. Control valve assembly.

HE 1.5 Twin Control Valve Parts List

Item	Part No.	Description
	01022173	HE 1.5 Control Valve, Complete
	01024392	HE 1.5 Twin Control Valve #2, Complete
1	01024839	Body Chambers, Welded, 1.5"
2	01025243	Piston Rebuild Kit, Includes 6ea Piston assemblies and 1ea Brine Piston Assembly
5	01022193	Gear Box Assembly
6	01024332	Gearmotor
7	P1020415	Retainer, Gearmotor, 10ea/Kit
8	—	Wire Harness w/ Optical Sensor (not available for sale)
8*	—	Wire Harness w/ Optical Sensor, Extended, Control #2 (not avail. for sale)
9	01022735	Wire Harness, Motor, HE
10	01025493	Wire Harness, Motor, HE, Extended
11	P1020433	Optical Sensor Screw, 10ea/Kit
12	P1023546	Gear Box Assembly Screw, 10ea/Kit
13	P1020289	Dial-a-Softness Knob, 10ea/Kit
14	P1022185	Dial-a-Softness Assembly w/ O-Rings, 10ea/Kit
15	P1020487	Plug Assy, Eductor Housing, HE, 10ea/Kit
16	P1020290	Eductor Plug Retainer, 10ea/Kit
17	P1020489	Plug, Backwash Assy, 10ea/Kit
18	P1020291	Backwash Bypass Retainer
19	P1024022	Drain Straight Fitting Assembly, 10ea/Kit
20	P1023021	Drain Elbow Assembly, 10ea/Kit
21	01023595	Cap, Vinyl
22	01023596	Cable, Tie, 2"
23	—	Frame, Hood, Compact, HE Control, Outdoor (not available for sale)
24	P1020432	Retainer, Brine & Drain Elbow, 10ea/kit
25	01024918	Cover, Hood, Compact, HE 1½" Control, Outdoor
26	P0440268	O-Ring, Brine & Drain Elbow, 10ea/Kit
27	P0401031	Backwash Flow Control, 5.5 gpm, 10ea/Kit
27	P0708008	Backwash Flow Control, 7 gpm, 10ea/Kit
27	P0708011	Backwash Flow Control, 11.5 gpm, 10ea/Kit
28	P0318383	Enclosure Screw, 10ea/Kit
29	P1023122	Retainer for Enclosure Screw, 10ea/Kit
31	P1025274	Strain Relief Fitting, 10ea/kit
32	P1025277	Liquid Tight Hole Plug, 10ea/kit
33	P1020617	Nut, 10ea/kit
34	—	Compartment Plate w/ Gaskets (not available for sale)
35	P1025278	Bushing, Strain Relief, 10ea/Kit
36	—	Enclosure w/ Decal and Keyboard (not available for sale)
38	01017134	Power Cord
39	01023550	Connector, Plumbing, 1½" NPT, Control 1½"
40	01020745	Replacement Circuit Board

Item	Part No.	Description
41	—	Enclosure w/ Decal (not avail. for sale)
42	01025650	Electronics Enclosure Kit w/o Circuit Board (includes items 8, 11, 28, 29, 32, 33, 34, 36)
43	01025652	Electronics Enclosure Kit, Twin, Control #2 (includes items 8, 28, 29, 32, 35, 41)
45	P1022796	Eductor Throat with O-rings, Downflow, Beige, 10ea/Kit
45	P1022723	Eductor Throat with O-rings, Downflow, Blue, 10ea/Kit
46	P1020603	Eductor Throat O-ring, Large, 10ea/Kit
47	P1020428	Eductor Throat O-ring, Small, 10ea/Kit
48	P1013895	Eductor Nozzle w/ O-ring, Beige, 10ea/Kit
48	P1024333	Eductor Nozzle w/ O-ring, Green, 10ea/Kit
48	01014253	Eductor Nozzle w/ O-ring, Yellow
49	P0308438	O-ring, Eductor Nozzle, 10ea/Kit
50	P1020256	Screen, 10ea/Kit
51	01019742	Disperser
52	P1023558	Retaining Ring, 10ea/Kit
53	P1023560	O-ring, Manifold, 10ea/Kit
56	P1024364	Large Piston, O-ring, 25ea/Kit
57	P1025239	Large Piston Quad Ring, 25ea/Kit
60	P1020431	Small Piston, O-ring, 25ea/Kit
61	P1025199	Small Piston Quad Ring, 25ea/Kit
62	P1020426	Brine Piston O-ring 25ea/Kit
63	P1025964	Brine Piston Quad Ring 25ea/Kit
64	P1020252	Main Piston Spring, 10ea/Kit
65	P1020286	Brine Piston Spring 10ea/Kit
70	P1009075	Retaining Clip
71	01014033	Coupling Kit
72	P1009099	O-ring, Couplings/Meters, 50ea/Kit
82	01021877	Meter Assembly 1"
83	01025490	Harness, Meter, 48" Long, Two Connectors, Outdoor
86	01024788	Interconnecting Tank Assembly (14" and 16" Tanks)
86	01024789	Interconnecting Tank Assembly (18" and 21" Tanks)
87	P1021162	O-ring
88	P1020424	O-ring
*	P0451701	Hose Clamp, Drain
*	P1023559	O-ring, Valve to Tank, 10ea/Kit
*	01014897	Transformer, Dual Output
*	01020620	Transformer, Dual Output w/ 6' Power Cord (optional)
*	P0443494	Adapter, 1/2" Tube X 1/2" NPT
*	P0440516	1/2" Tube Insert, 25ea/Kit
*	P1024720	1/2" Tee
*	01024216	1½" Bypass Valve
*	P1014426	Backwash Flow Control, Spacer, 10ea/Kit
*	01025281	Bypass Piston Kit for HE 1.25/1.5

*Not shown in diagram


Replacement Softener Tanks

Model No.	Tank Size	Replacement Tank Part No.	Manifold Part No.	Underbedding Required			Cullex® Resin Req'd Bags ¹
				Lbs.	Bags	Part No.	
HE-060	14x47	01019578 ²	01011985	30	1	00160707	2
HE-090	16x53	01019577 ²	01011985	40	2	00160702	3
HE-120	16x65	01019579 ²	01011985	40	2	00160702	4
HE-150	18x65	01025244 ²	01019618	70	1	00160702	5
					1	00160710	
HE-210	21x62	01025245 ²	01019618	80	4	00160702	7
HE-150	21x54	A2365031 ³	01019618	80	4	00160702	5
HE-210	21x69	A2365032 ³	01019618	80	4	00160702	7

¹Each Cullex (00156001) bag is 1 cubic foot.

²These tanks have an Aqua-Sensor® port in top head.

³These tanks do NOT have a port in the head.

 = Legacy equipment: not available in this and future releases

NOTE Some tank sizes changed in August 2009. Refer to Bulletin CI-0914 for replacement tanks on systems prior to that date.

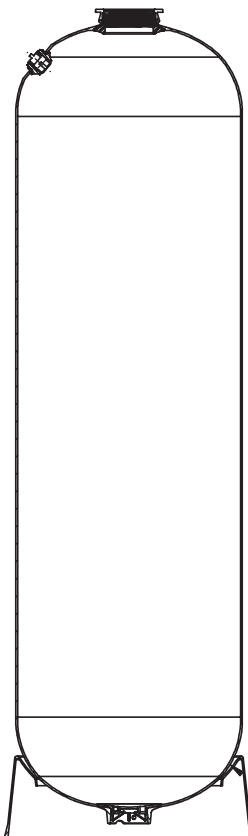
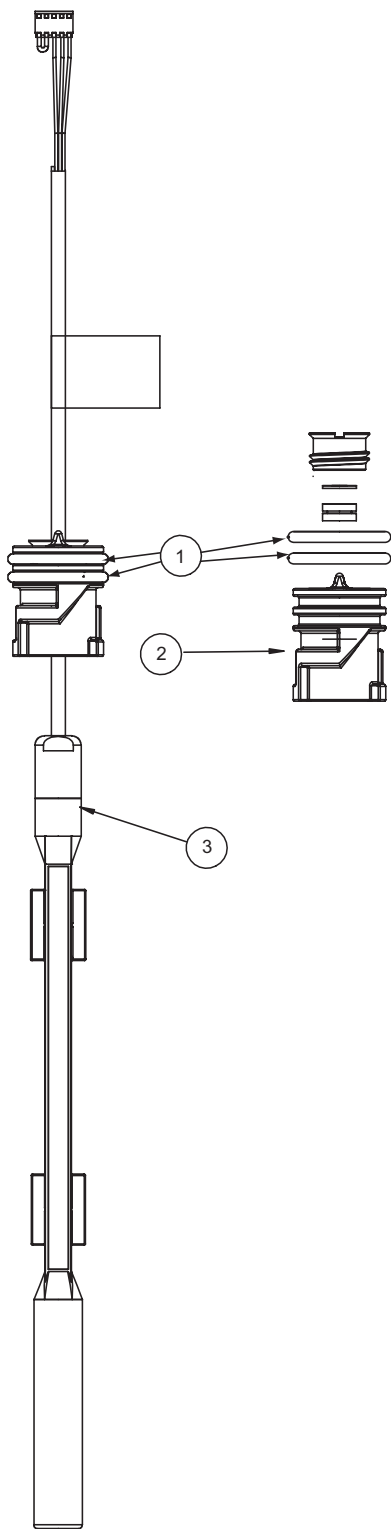


Figure 66. HE 1.5 tank assembly.

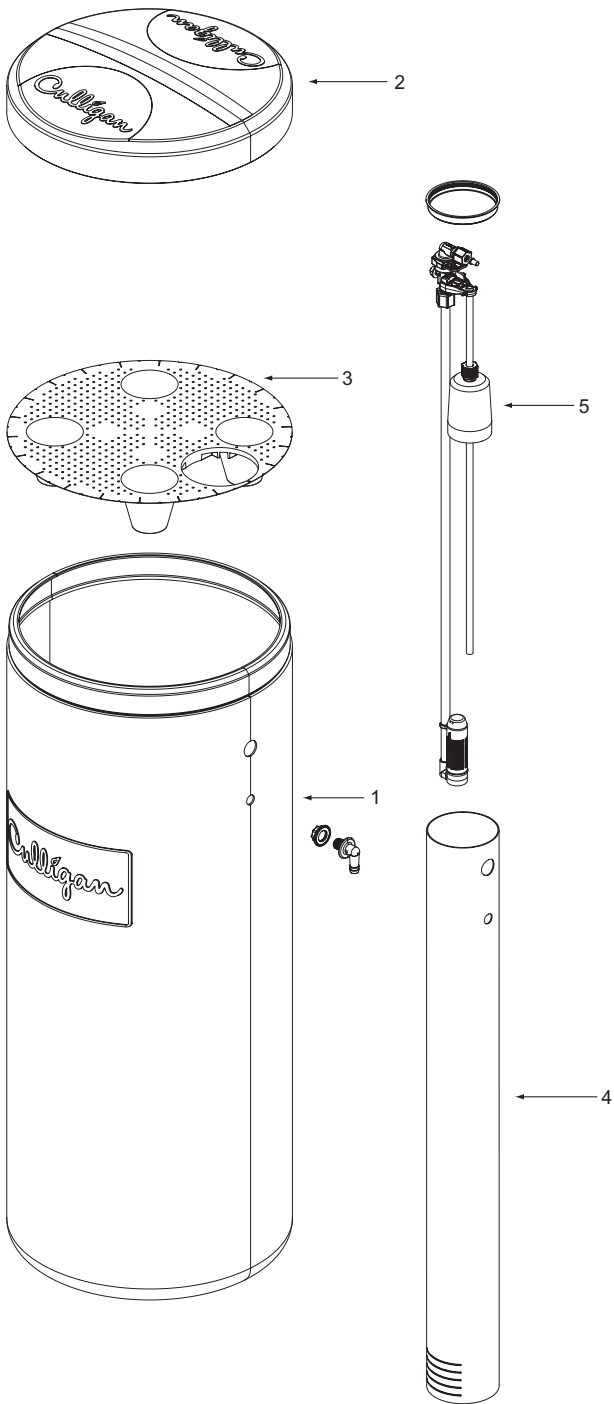
Aqua-Sensor Plug and Probe



Item No.	Part No.	Description	Qty
1	P1017434	O-Ring, Plug and Sensor, 10ea/Kit	2
2	01015122	Aqua-Sensor Plug	1
3	01025283	Aqua-Sensor Probe, HE 1.5	1

Figure 67. Aqua-Sensor probe.

18"x38" and 24"x40" Brine Systems



Item No.	Qty.	Part No.	Description
		01019525	18" x 38" Brine System Complete
		01018720	24" x 40" Brine System Complete
1	1	01018716	Tank Repl 18" x 38"
1	1	01018718	Tank Repl 24" x 48"
2	1	01018717	Cover Repl 18"
2	1	01018719	Cover Repl 24"
3	1	01018713	Salt Plate Repl 18"
3	1	01018714	Salt Plate Repl 24" (7 pack)
4	1	01018708	Brine Well with Cap
5	1	01018706	Brine Valve Repl 24" (1/2")
5	1	01019526	Brine Valve Repl 18" (1/2")

Figure 68. 18"x38" and 24"x40" brine systems.

24"x50" Brine System

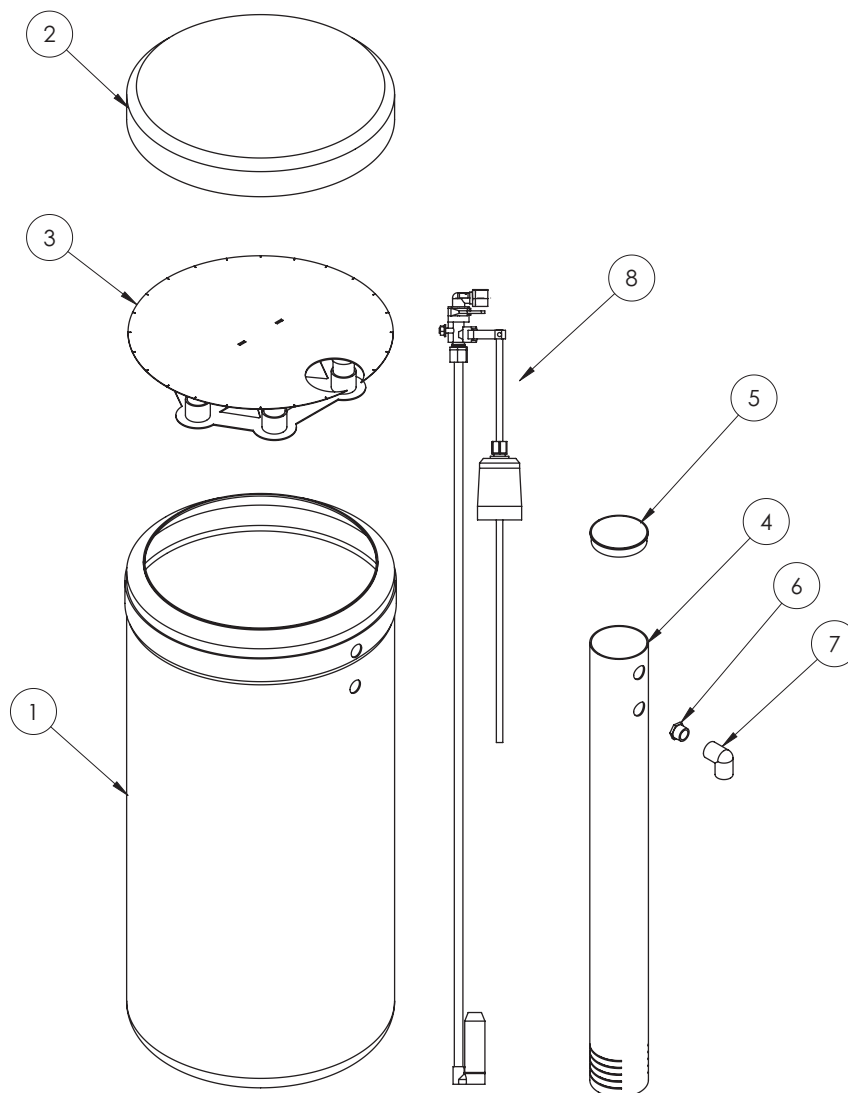
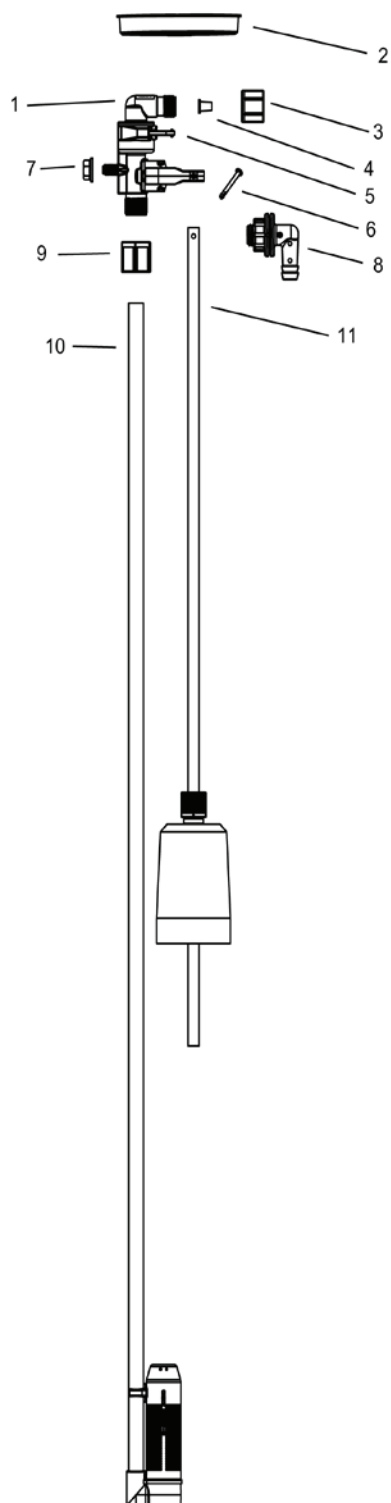


Figure 69. 24"x50" brine system.

Item No.	Part No.	Description	Qty
—	01024638	24"x50" Brine System Complete, 0.8 gpm, 1/2" Connection, 0.8 BLFC	
1	—	Tank	1
2	—	Cover	1
3	01019623	Salt Plate, 24"	1
4	01019621	Brine Well	1
5	01019622	Brine Well Cap	1
6	01024662	Bushing, 3/4" x 1" NPT	1
7	01024660	Elbow, 1" NPT x 1" Socket	1
8	01024634	Brine Valve, 1/2" Connection, 0.8 gpm, BLFC	1

Brine Valve Assembly



Item No.	Part No.	Description
—	01019526	Brine Valve for 18"
—	01018706	Brine Valve for 24"
1	01018710	BLFC Elbow - 0.45 gpm
	01018711	BLFC Elbow - 0.8 gpm
2	P1020194	Brine Well Cap - 24 Pack
3	P1020196	3/8" Compression Nut - 24 Pack
4	P1018871	3/8" Insert - 25 Pack
5	P1012091	Retaining Clip - 24 Pack
6	P1020192	Pin - 24 Pack
7	P1020193	5/16" Nut - 24 Pack
8	P1020190	Overflow Fitting w/ Nut - 24 Pack
9	P1020195	3/8" Nut - 24 Pack
10	P1020198	Air check Assembly - 24 Pack
11	P1020197	Float - 24 Pack

Figure 70. Brine valve assembly.

Accessories

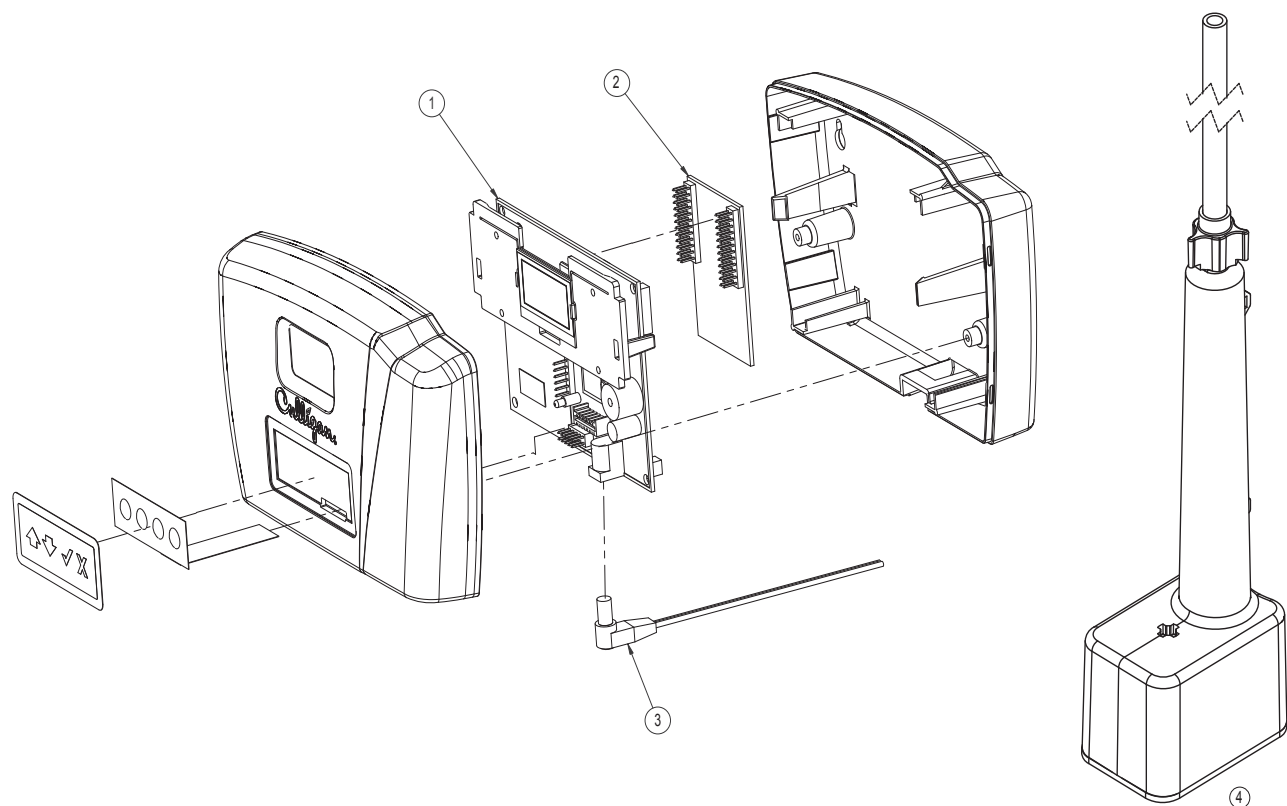


Figure 71. Accessories.

Accessories Parts List

Item No.	Part No.	Description
	01020553	Remote Display
1	01020749	Remote Display Circuit Board
2	01020750	RF Board
3	01020611	Transformer
4	01025557	Smart Brine Tank Sensor Assembly, HE Outdoor
Cables and Kits		
	01020747	Modem
	01025279	Aqua-Sensor Hanging HE 1.5" Outdoor
	01021402	SBT Extension Cable, 20 ft.
	01021507	PLC-USB Communication Cable
	01021509	PLC-RS485 Communication Cable
	01021508	PLC-RS232 Communication Cable
	01023103	PLC-Modbus Communication Cable
	01020748	Auxiliary Circuit Board
	01022238	Alarm Relay Circuit Board
	01025561	Transformer, Outdoor, 24V, HE Compact Hood

Appendix A HE 1.5 Twin Flow Diagrams

HE 1.5 Twin Flow Valve Piston Locations

The flow valve controls the movement of untreated and treated product during downflow and upflow regeneration cycles. Figure 71 identifies each piston as installed. For example, in this cycle (downflow service), the P1 and P2/P3 valves are open; the P4, P5, P6, and PR valves and the Brine Piston are closed.

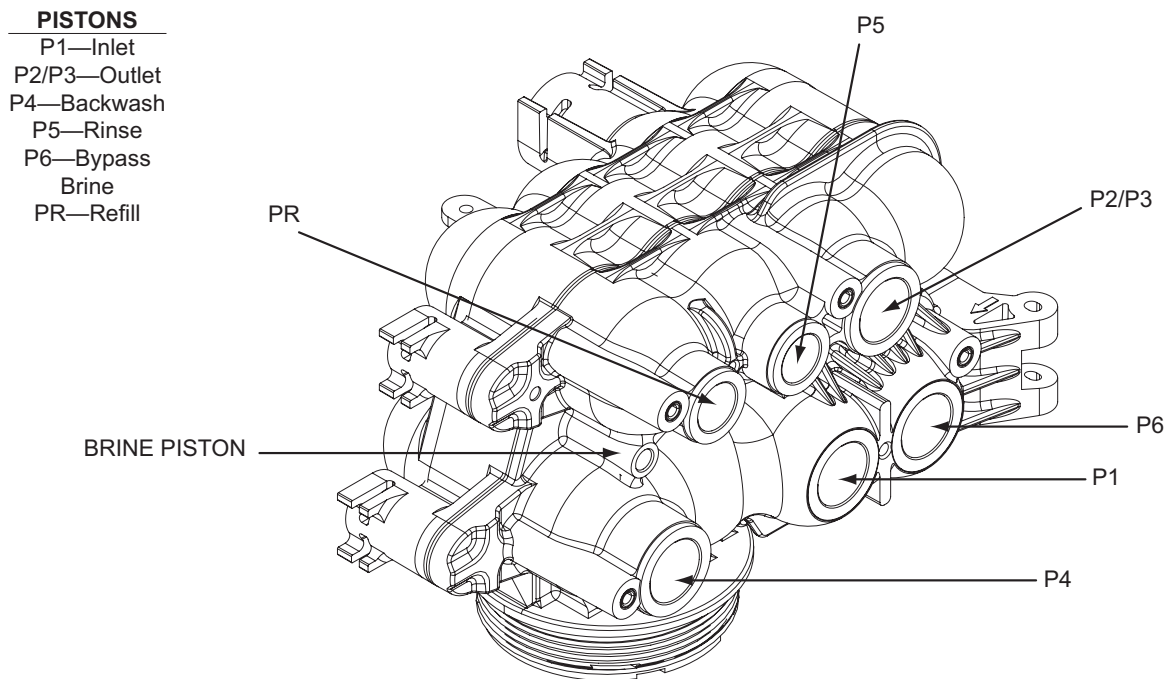


Figure 72. HE 1.5 Twin valve piston locations.

The cycle sequence is different for downflow regeneration than for upflow regeneration. Note the regeneration cycle sequence for downflow and upflow regeneration.

Downflow Regeneration Cycle Sequence

1. Service
2. Backwash
3. Brine Draw/Slow Rinse
4. Fast Rinse
5. Refill (Brine)
6. Bypass

See page 120 through page 126 for Downflow Regeneration flow diagrams.

Service

Raw water is allowed in the inlet to the top of the tank. The water is run through the resin up the manifold to the outlet. The water to the outlet should be soft if the system is operating properly.

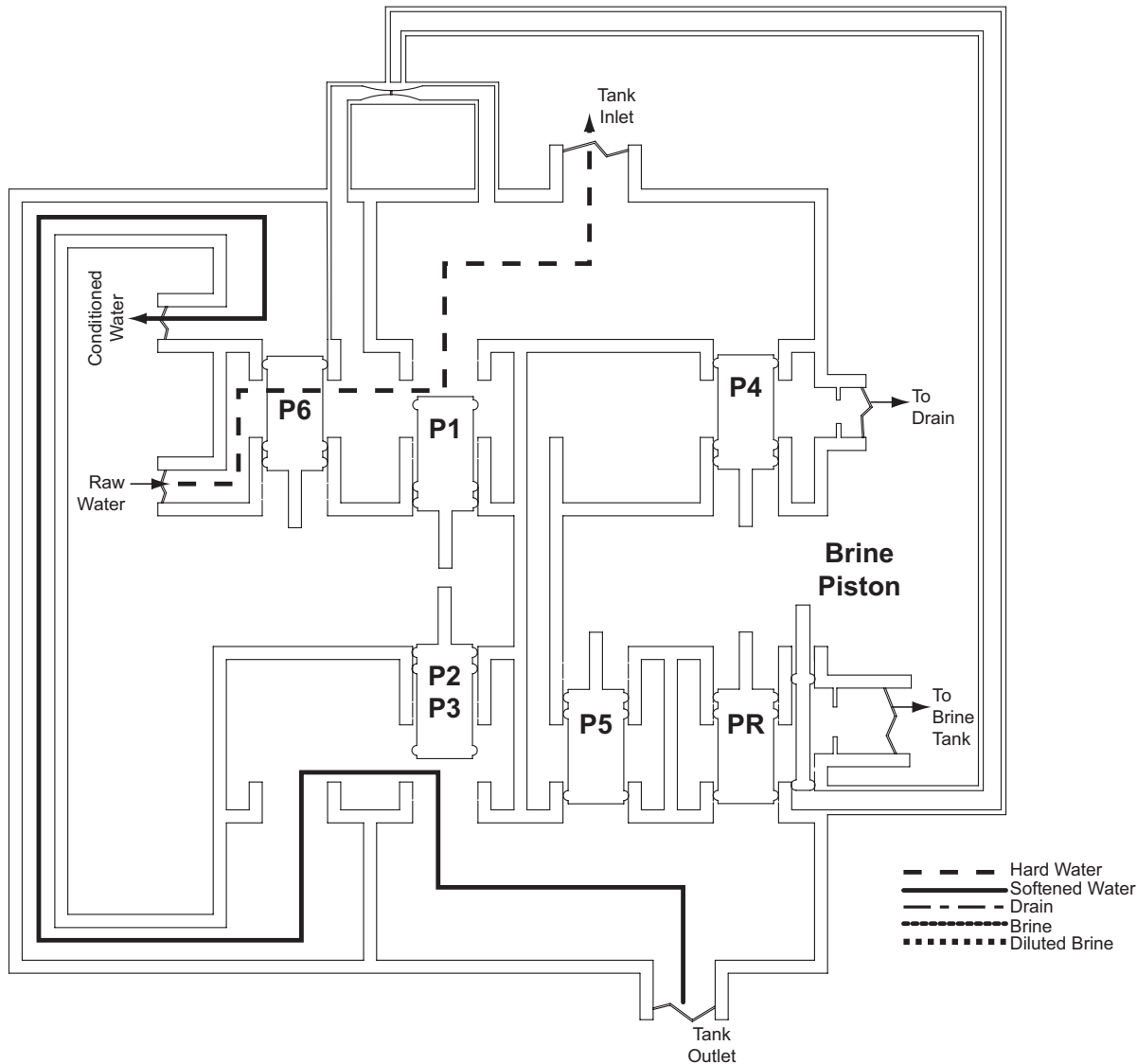


Figure 73. Down flow regeneration—service.

Service	
Piston	Position
P1–Inlet	Open
P2/3–Outlet	Open
P4–Backwash	Closed
P5–Rinse	Closed
P6–Bypass	Closed
Brine Piston	Closed
PR–Refill	Closed

Backwash

Raw water is directed down the center of the manifold, up through the resin, out the top of the tank to drain. The water to drain should be hard.

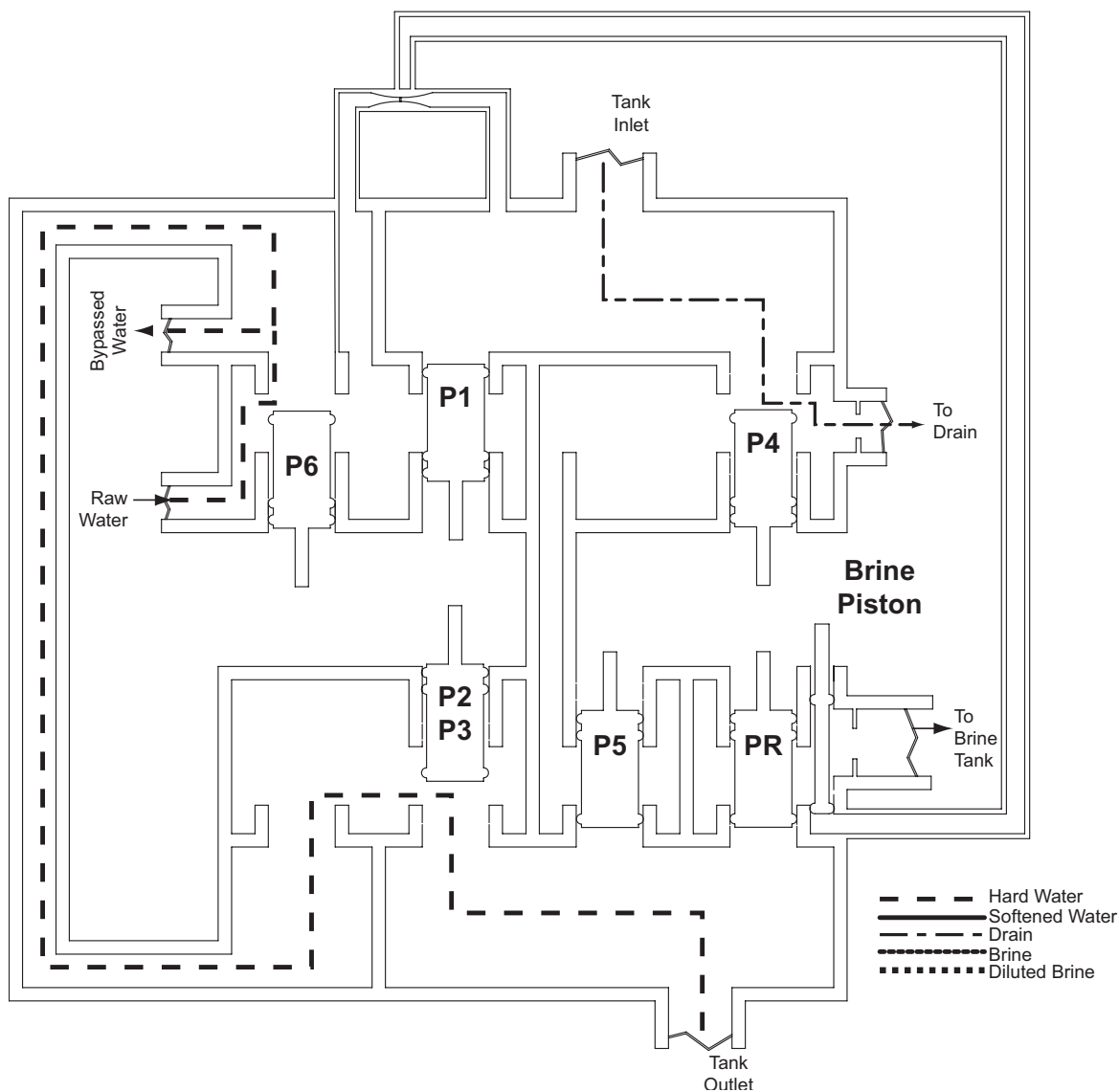


Figure 74. Down flow regeneration—backwash.

Backwash	
Piston	Position
P1—Inlet	Closed
P2/3—Outlet	Open
P4—Backwash	Open
P5—Rinse	Closed
P6—Bypass	Open
Brine Piston	Closed
PR—Refill	Closed

Brine Draw

Raw water is directed from the inlet through the nozzle and into the throat. A vacuum is created and concentrated brine is educted (drawn). The raw water and concentrated brine combine, enter the mineral tank, and pass through the resin, up the manifold and to the drain. Once all of the brine has been educted and the brine valve seats, the unit goes into slow rinse. Hard water is allowed to service during regeneration.

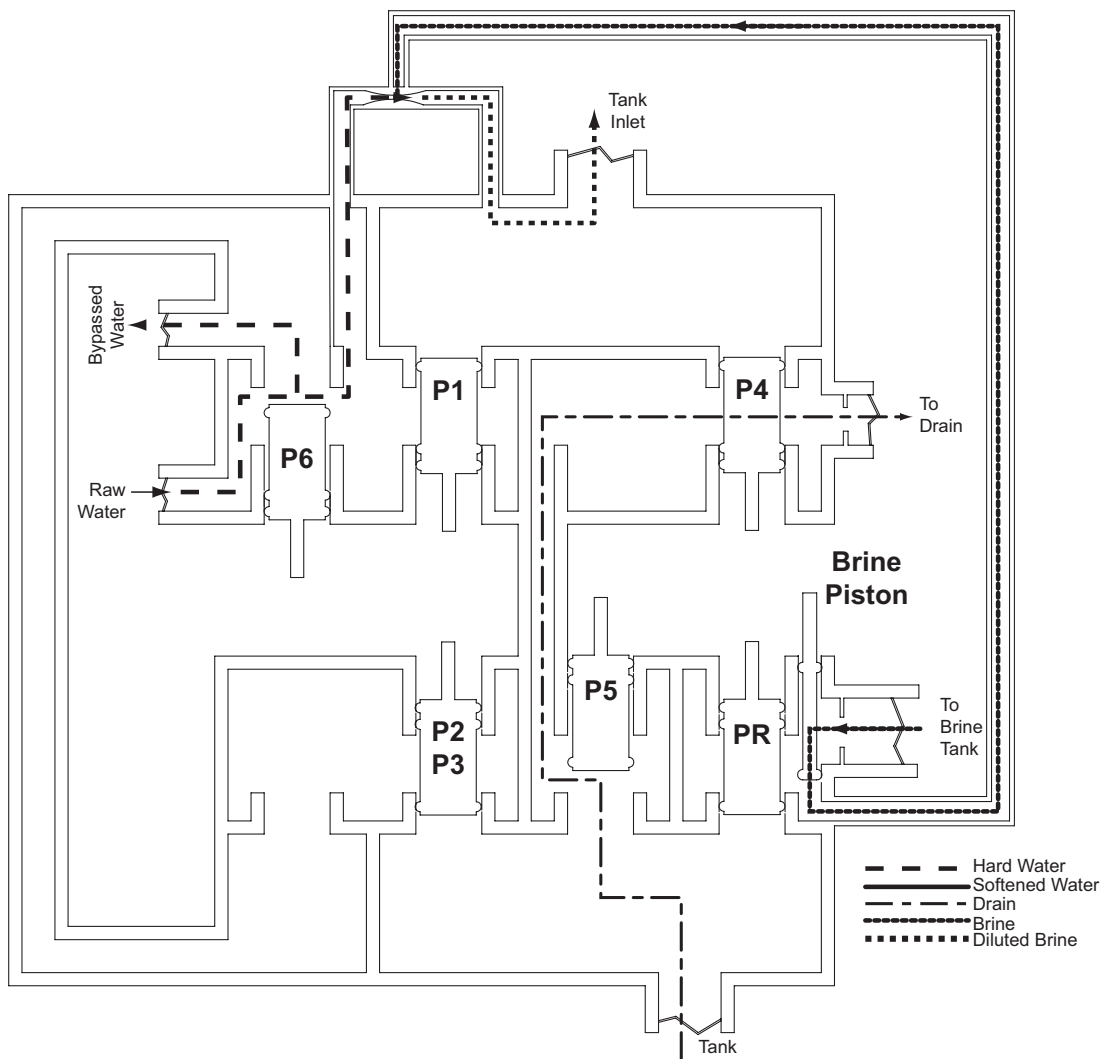


Figure 75. Down flow regeneration—brine draw.

Brine Draw	
Piston	Position
P1—Inlet	Closed
P2/3—Outlet	Closed
P4—Backwash	Closed
P5—Rinse	Open
P6—Bypass	Open
Brine Piston	Open
PR—Refill	Closed

Slow Rinse

Raw water is directed from the inlet through the nozzle and into the throat. A vacuum is created but the brine valve has seated, so no brine is educted. The raw water enters the mineral tank, passes through the resin, up the manifold and to the drain. Hard water is allowed to service during regeneration.

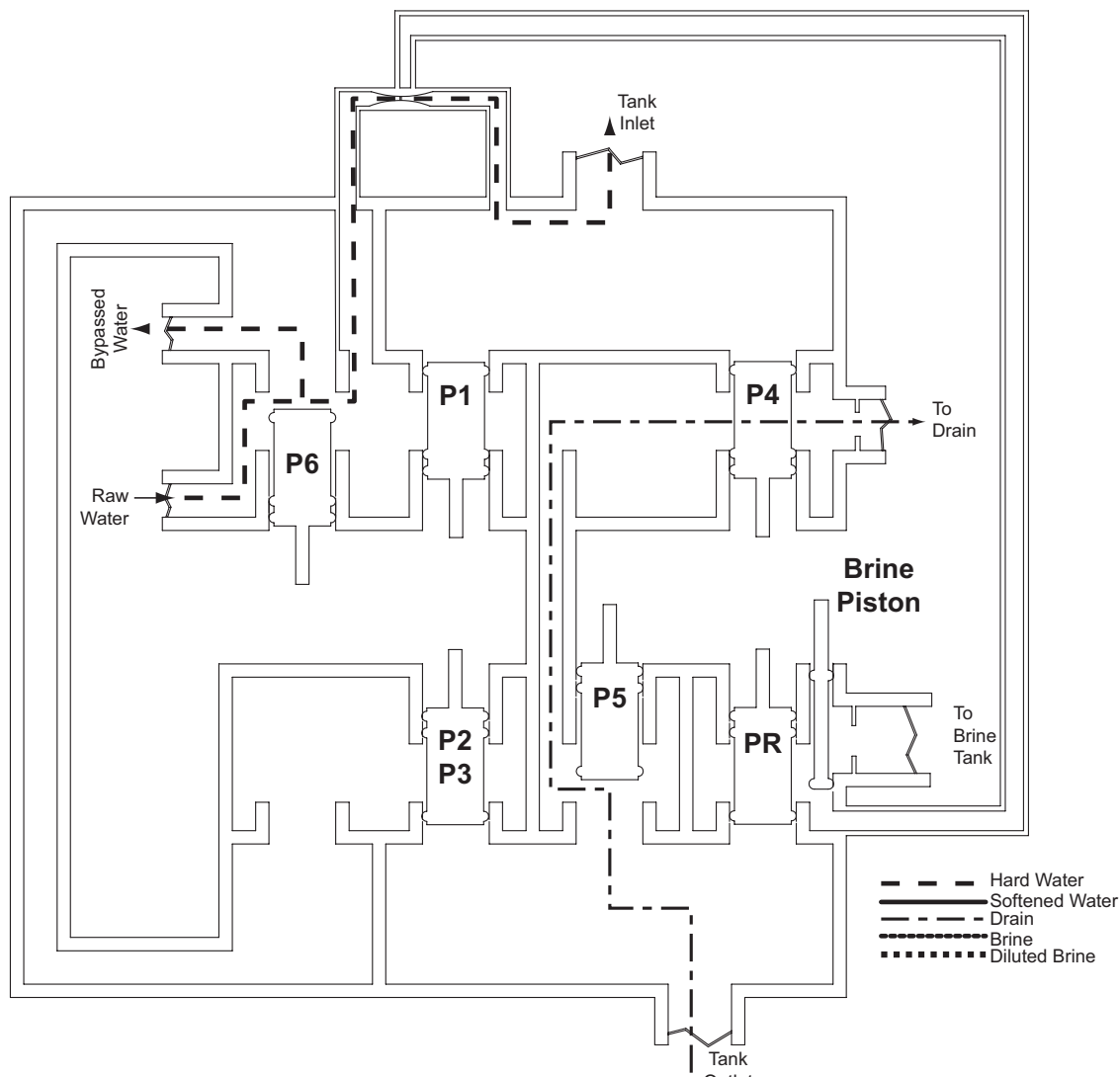


Figure 76. Down flow regeneration—slow rinse.

Slow Rinse	
Piston	Position
P1—Inlet	Closed
P2/3—Outlet	Closed
P4—Backwash	Closed
P5—Rinse	Open
P6—Bypass	Open
Brine Piston	Open
PR—Refill	Closed

Fast Rinse

Raw water is directed from the inlet to the top of the tank, down the resin, up the manifold, and out to drain. Hard water is allowed to Service during regeneration.

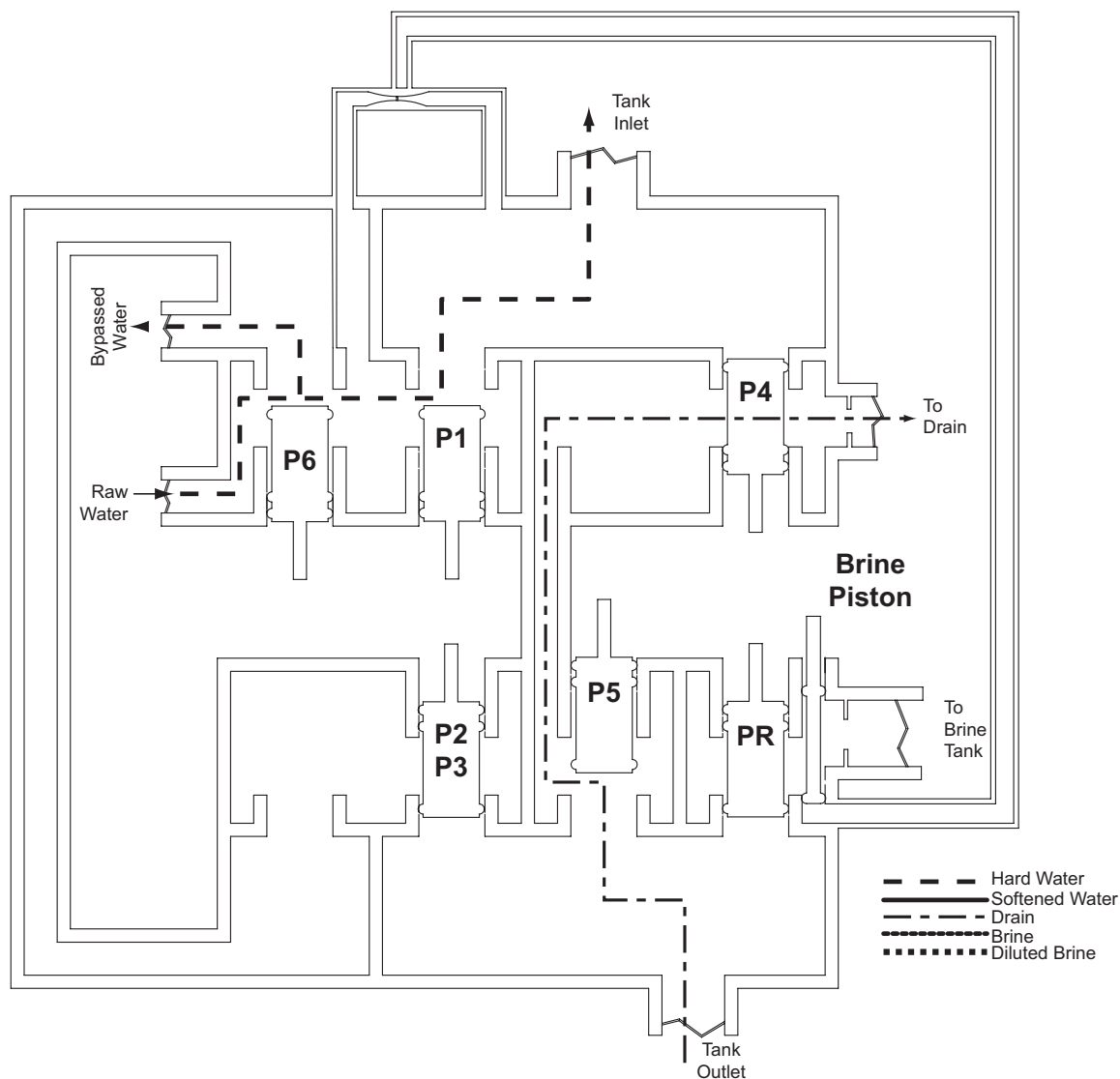


Figure 77. Down flow regeneration—fast rinse.

Fast Rinse	
Piston	Position
P1—Inlet	Open
P2/3—Outlet	Closed
P4—Backwash	Closed
P5—Rinse	Open
P6—Bypass	Open
Brine Piston	Closed
PR—Refill	Closed

Refill

To make the brine, water flows into the salt storage area during the fill stage. Fill cycle length depends on the salt dosage. Use soft water for refill.

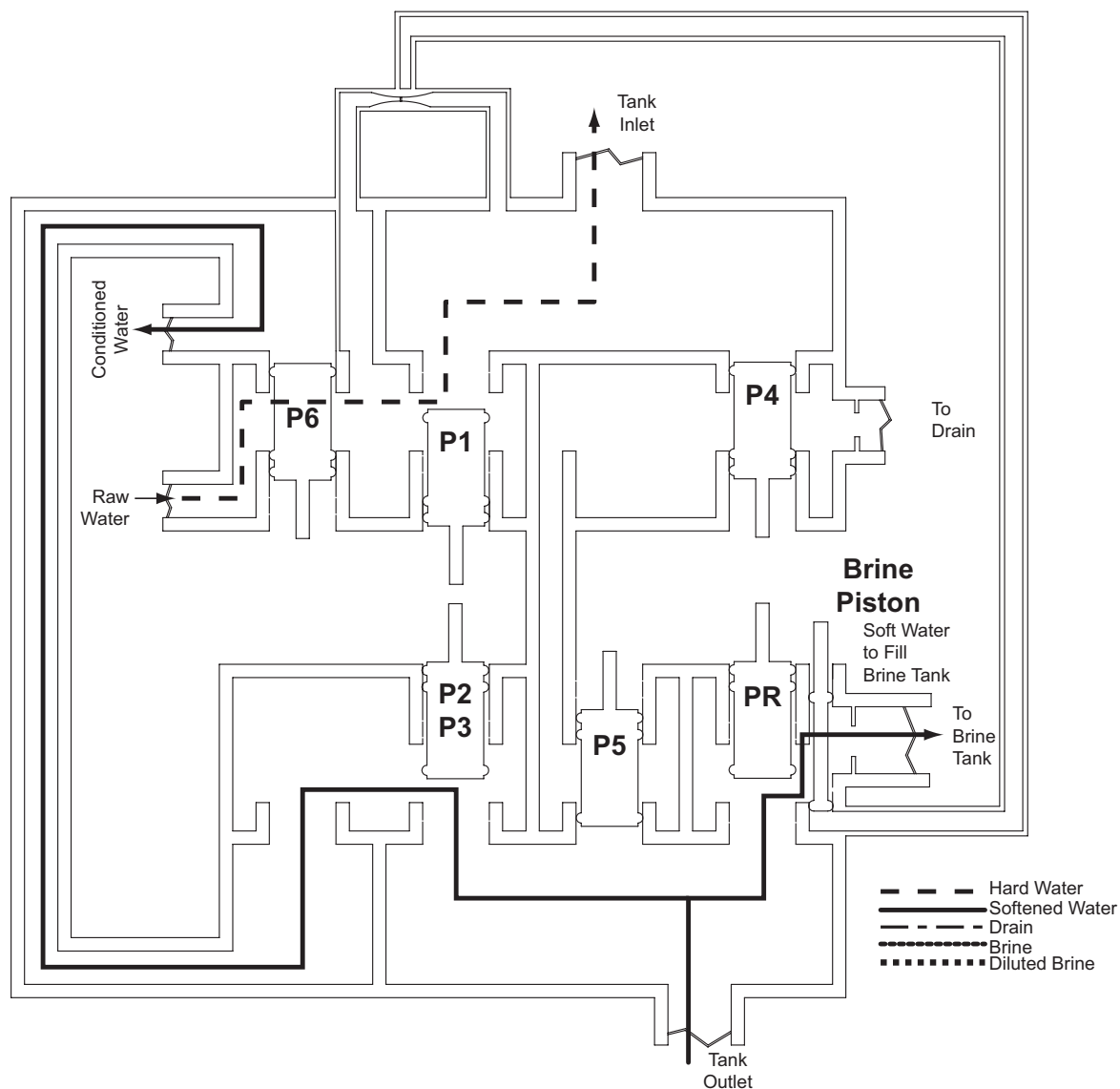


Figure 78. Down flow regeneration—refill.

Refill	
Piston	Position
P1–Inlet	Open
P2/3–Outlet	Open
P4–Backwash	Closed
P5–Rinse	Closed
P6–Bypass	Closed
Brine Piston	Closed
PR–Refill	Open

Bypass

The HE control can be bypassed for a preset time duration. Raw water is allowed in the inlet of the control and internally bypassed to the outlet of the control (hard water is allowed to service).

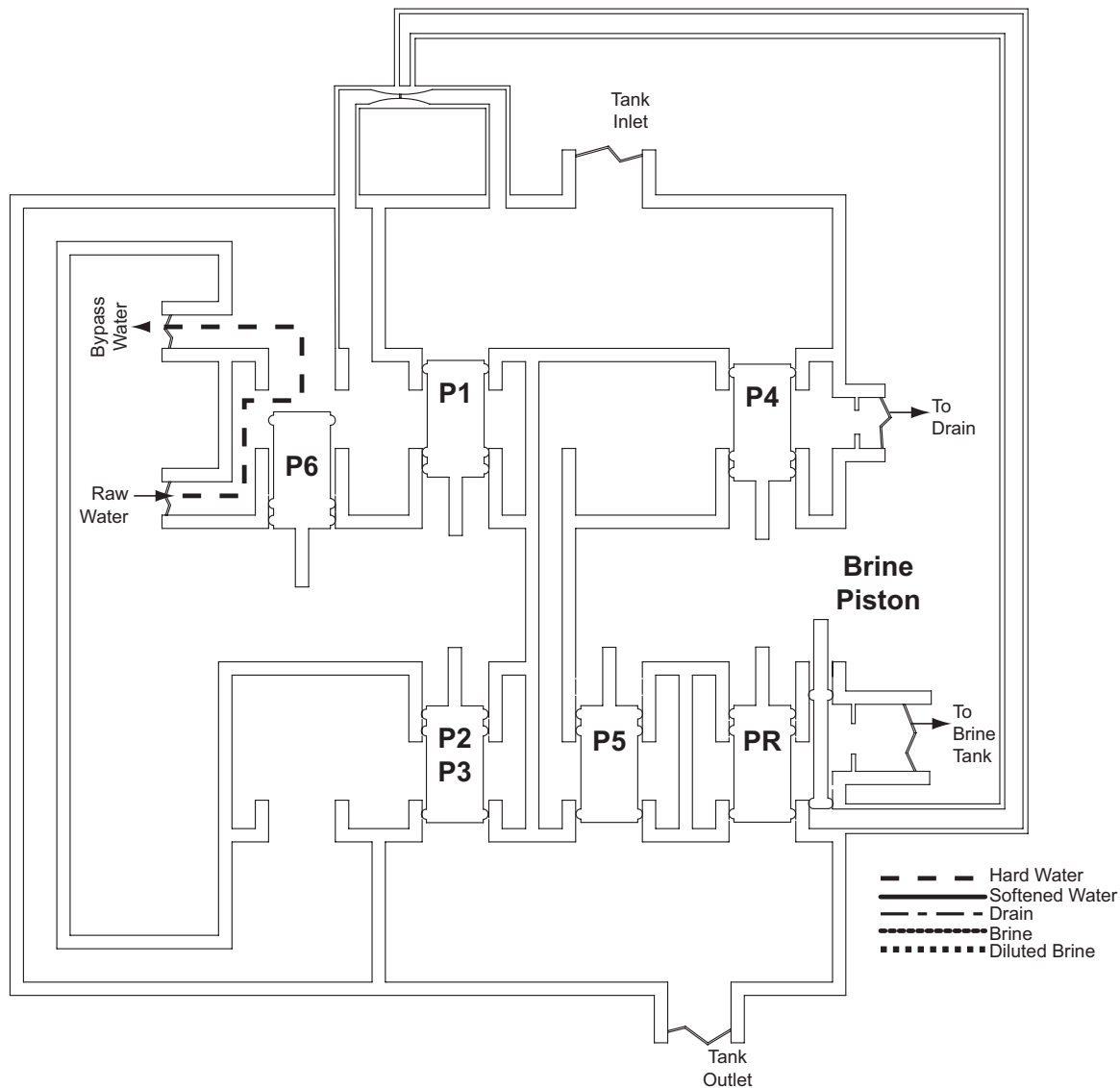


Figure 79. Down flow regeneration—bypass.

Bypass	
Piston	Position
P1–Inlet	Closed
P2/3–Outlet	Closed
P4–Backwash	Closed
P5–Rinse	Closed
P6–Bypass	Open
Brine Piston	Closed
PR–Refill	Closed

Appendix B Aqua-Sensor Guidelines

Aqua-Sensor Application Guidelines

Parameter	Value
Hardness (gpg as CaCO ₃)	7 - 99 (See Notes 1 & 2)
Soluble iron (ppm as Fe)	< 2 (See Note 3)
Manganese (ppm as Mn)	< 0.5 (See Note 4)
Hardness versus Salt Dosage	See Table 18 and Note 2
TDS to Hardness Index	TDS hardness (as CaCO ₃) <10 (i.e., hardness must be at least 10% of TDS; see Note 5)
Temperature, °F	Any within equipment's operating range
Alum and phosphate	Anecdotal evidence indicates potential foulant; effect has not been confirmed experimentally
Commercial cell: distance between sensing and reference cell pairs	6 inches (See Note 2)

Table 13.

Hardness vs. Salt Dosage

Hardness (gpg as CaCO ₃)	Recommended Salt Dosage (lbs/ft ³)
7-10	5-6
10-15	6-8
15-25	8-9
25-50	9-11
50-75	11-12
75-99	12-16

Table 14.

Resin Bed Depths and Estimated Capacity Per Inch at Various Salt Dosages

Model	Tank Size	Resin Qty	Depth of Resin (in.)	Grains Capacity per inch (10 lb/ft ³ salt dosage)	Grains Capacity per inch (6 lb/ft ³ salt dosage)	Grains Reserve Capacity@10 lb/ft ³ salt dosage	Grains Reserve Capacity@ 6 lb/ft ³ salt dosage
HE-060	14x47	2	22.5	2227	1782	13363	10690
HE-090	16x53	3	25.8	2909	2327	17453	13963
HE-120	16x65	4	34.4	2909	2327	17453	13963

Table 15.

NOTE

- Although the Aqua-Sensor device has been used successfully on water with hardness as low as 3 gpg, there is an increased risk of missed signal (no regeneration) when the hardness is less than 6 gpg.
- For each tank diameter, there is a specific volume of resin in the space between the cell pairs. The capacity of that resin is influenced by hardness and salt dosage. Any combination of flow rate and hardness that causes the hardness front to pass through that volume of resin in less than 6 minutes will result in the sensor failing to detect the need to regenerate. In general, the volume of resin between the cell pairs on commercial units will permit a proper signal at or below the continuous flow rating when raw water hardness is less than 50 gpg. At higher hardness levels, it may be necessary to reduce the flow rate to assure adequate sensor signal duration.
- If precipitated or bound iron is present it must be removed before the softener.
- Manganese can deposit on the sensor electrodes, particularly on the upper pair, causing missed signals (no regeneration). Periodic cleaning may be needed to maintain satisfactory performance.
- Adequate signal strength has been demonstrated at ratios as high as 14 but signal strength diminishes with decreasing TDS to hardness index.
- Amount shown is based on the distance between the referencing cell pairs. Reserve capacity at salt dosages less than 15 lbs per cubic foot are shown for reference purposes only and may not provide adequate representation of actual capacity per inch of bed depth for operational purposes.

Appendix C Flow Data

High Efficiency Twin 1.5 Water Softeners—Flow Rate Data (gpm)

Model	Service			*Suggested Progressive Flow Trip Point	Drain			
	Minimum	Continuous	Peak		Back-wash	Brine Draw	Slow Rinse	Fast Rinse
HE-060	2.1	25.1	31.5	18.8	5.5	0.93	0.73	5.5
HE-090	2.8	26.6	35.2	20.0	5.5	1.52	1.43	5.5
HE-120	2.8	23.3	31.8	17.5	5.5	1.48	1.19	5.5
HE-150	5	27.2	35.8	20.4	7.1	1.5	1.28	7.1
HE-210	11.5	28.0	37.4	21	11.5	1.9	1.6	11.5

Table 16. High Efficiency 1.5 Twin flow rate data.

*The Suggested Progressive Flow Trip Point is simply a suggested flow rate at which point an additional tank will be brought on line if facility flow demand meets this rate. The Culligan Controller will not remove a tank brought on line by attaining the Trip Point unless the flow is <95% of the Trip Point amount for a 60-second period. In the event additional units are not brought on line or off line when desired, simply adjust the programmed Trip Point. Refer to the system instruction manual, Operation and Programming sections for more information about the Progressive Flow mode of operation.

High Efficiency 1.5 Twin Refill Minutes/Salt Dosage/Capacity

Resin Vol (ft³)		2		3		4		5		7					
Refill flow Restricted to (gpm)		0.8													
Resin Tank Dia. (in.)	Refill Min	14		16		16		18		21					
		lbs/ft³	Dosage	Capacity	lbs/ft³	Dosage	Capacity	lbs/ft³	Dosage	Capacity	lbs/ft³	Dosage	Capacity		
3		3.6	7.2		2.4	7.2		1.8	7.2		1.4	7.2		1.0	7.2
4		4.8	9.6		3.2	9.6		2.4	9.6		1.9	9.6		1.4	9.6
5		6	12	40,000	4	12		3	12		2.4	12		1.7	12
6		7.2	14.4		4.8	14.4		3.6	14.4		2.9	14.4		2.1	14.4
7		8.4	16.8		5.6	16.8		4.2	16.8		3.4	16.8		2.4	16.8
8		9.6	19.2		6.4	19.2	60,000	4.8	19.2		3.8	19.2		2.7	19.2
9		10.8	21.6	50,000	7.2	21.6		5.4	21.6		4.3	21.6		3.1	21.6
10		12	24		8	24		6	24	80,000	4.8	24		3.4	24
11		13.2	26.4		8.8	26.4		6.6	26.4		5.3	26.4		3.8	26.4
12		14.4	28.8		9.6	28.8		7.2	28.8		5.8	28.8		4.1	28.8
13		15.6	31.2	60,000	10.4	31.2	75,000	7.8	31.2		6.2	31.2	100,000	4.5	31.2
14					11.2	33.6		8.4	33.6		6.7	33.6		4.8	33.6
15					12	36		9	36		7.2	36		5.1	36
16					12.8	38.4		9.6	38.4		7.7	38.4		5.5	38.4
17					13.6	40.8		10.2	40.8	100,000	8.2	40.8		5.8	40.8
18					14.4	43.2		10.8	43.2		8.6	43.2		6.2	43.2
19					15.2	45.6	90,000	11.4	45.6		9.1	45.6		6.5	45.6
20								12	48		9.6	48		6.9	48
21								12.6	50.4		10.1	50.4	125,000	7.2	50.4
22								13.2	52.8		10.6	52.8		7.5	52.8
23								13.8	55.2		11.0	55.2		7.9	55.2
24								14.4	57.6		11.5	57.6		8.2	57.6
25								15	60	120,000	12.0	60		8.6	60
26									62.4		12.5	62.4		8.9	62.4
27									64.8		13.0	64.8		9.3	64.8
28									67.2		13.4	67.2		9.6	67.2
29									69.6		13.9	69.6		9.9	69.6
30									72		14.4	72		10.3	72
31									74.4		14.9	74.4		10.6	74.4
32									76.8	150,000	15.4	76.8		11.0	76.8
33														11.3	79.2
34														11.7	81.6
35														12.0	84
36														12.3	86.4
37														12.7	88.8
38														13.0	91.2
39														13.4	93.6
40														13.7	96
42														14.4	100.8
43														14.7	103.2
44														15.1	105.6
															210,000

High Efficiency 1.5 Twin Brinemaker Data—1/2" Valves

		1/2" Brine Valve Size					
		18		24x40		24x50	
Cubic feet	Soft Tank Dia	Total lbs.	lbs/ft ³	Total lbs.	lbs/ft ³	Total lbs.	lbs/ft ³
2	14	34.7	17.4	61.7	30.9	61.7	30.9
3	16	34.7	11.6	61.7	20.6	61.7	20.6
4	16	34.7	8.7	61.7	15.4	61.7	15.4
5	18	34.7	6.9	61.7	12.3	61.7	12.3
7	21	NA	NA	61.7	8.8	61.7	8.8

Chart shows max salt dosage for dry storage in total lbs and lbs/ft³

Table 17. High Efficiency 1.5 Twin brinemaker data, 1/2" valves.

		1/2" Brine Valve Size					
Mineral Tank	Brine Dia	18		24x40		24x50	
	Max Load lbs	375		600		900	
Cubic Feet	lbs/ft ³	Max Load	# regens	Max Load	# regens	Max Load	# regens
2	6	375	31.3	600	50	900	75
	10	375	18.8	600	30	900	45
	15	375	12.5	600	20	900	30
3	6	375	20.8	600	33.3	900	50
	10	375	12.5	600	20	900	30
	15	267	5.9	600	13.3	900	20
4	6	375	15.6	600	25	900	37.5
	10	292	7.3	600	15	900	22.5
	15	193	3.2	600	10	900	15
5	6	375	12.5	600	20	900	30
	10	243	4.9	600	12	900	18
	15	119	1.6	500	6.7	500	6.7
7	6	282	6.7	600	14.3	900	21.4
	10	144	2.1	524	7.5	524	7.5
	15			352	3.4	352	3.4

 = wet storage



















































Table 18. High Efficiency 1.5 Twin tank data, 1/2" valves.

Appendix D Quick Reference

Quick Reference—First Time Setup For a High Efficiency 1.5 Twin Softener

- Hardness: 24 gpg
- Downflow regeneration
- No other accessories connected
- No default settings need to be changed


























NOTE The HE 1.5 Twin softener installation may require additional steps depending on which accessories are connected. Follow the installation procedure prior to first time setup, including: softener placement; tank assembly; control valve mounting; bypass valve installation; plumbing connection; modem installation, programming, and testing; remote display installation; and start up.

FIRST TIME SETUP PRESS DOWN ARROW	1. When the screen displays FIRST TIME SETUP , press  to view and change (if necessary) the softener configuration.	VALVE TYPE HE 1.5 TWIN	10. Press  to keep the default. Press   or  and then  to change the valve type setting.
S/W: 00000123 FWR217LT01 Jul 24 2012	2. The screen displays the serial number and firmware version for the HE 1.5 Controller. Press  to view the month setting.	UNITS US INCH	11. Press   or  and then  to change the units of measure if necessary.
SET MONTH JAN	3. Press   or  and then  to change the month setting.	INSTALL TYPE Commercial	12. Press  to keep the default installation type setting.
SET DAY 1	4. Press   or  and then  to change the day setting.	TOTAL CAPACITY 12500 GALLONS	13. Press  to keep the default total capacity setting.
SET YEAR 2012	5. Press   or  and then  to change the year setting.	BRINING TYPE Downflow	14. Press   or  and then  to change the brining type setting if necessary.
CLOCK TYPE 12 HR	6. Press   or  and then  to change the clock type setting.	BRINE DRAW-RINSE 60 MINUTES	15. Press   or  and then  to change the brine draw rinse setting if necessary.
SET HOUR 12PM	7. Press   or  and then  to change the hour setting.	FILL TIME 10 MINUTES	16. Press   or  and then  to change the fill time setting if necessary.
SET MINUTES 01	8. Press   or  and then  to change the minutes setting.	Initializing JAN-01-12 12:29P	17. The HE 1.5 Controller initializes and then the softener finds the HOME position.
UNIT TYPE SOFTENER	9. Press  to keep the default unit type setting.	Softening JAN-01-12 12:29P	18. The Controller screen displays the home screen.































Quick Reference—Progressive Flow

For a High Efficiency 1.5 Twin Softener with Meter

Set Up Unit 2 (Slave 1)

- | | |
|--|--|
| Softening
JAN-01-12 12:29P | 1. From the HOME screen, press  to view the main menu. |
| 2)MANUAL MODE
3)SET DATE/TIME
4)ACCESSORIES
>5)ADV. SETUP | 2. The screen displays the main menu. Press      to select 5)ADV. SETUP . |
| >1)SYSTEM SETUP
2)REGEN SETUP
3)CYCLE TIMES
4)REGEN TRIGGER | 3. Press  to select 1)SYSTEM SETUP . |
| MULTITANK SYSTEM
>PROGRESS FLOW | 4. Press        to display the Multi-tank System setting. |
| | 5. Press   or   to change the system configuration to PROGRESSIVE FLOW . |
| PROGRESS FLOW
SLAVE1 | 6. Press   or   to specify Unit 2 as a slave unit for Unit 1. |
| Softening
JAN-01-12 12:29P | 7. Press    to save the settings and display the HOME screen. |

Set Up Unit 1 (Master)

- | | |
|--|--|
| Softening
JAN-01-12 12:29P | 1. From the HOME screen, press  to view the main menu. |
| 2)MANUAL MODE
3)SET DATE/TIME
4)ACCESSORIES
>5)ADV. SETUP | 2. The screen displays the main menu. Press      to select 5)ADV. SETUP . |
| >1)SYSTEM SETUP
2)REGEN SETUP
3)CYCLE TIMES
4)REGEN TRIGGER | 3. Press  to select 1)SYSTEM SETUP . |
| MULTITANK SYSTEM
>PROGRESS FLOW | 4. Press        to display the Multi-tank System setting. |
| | 5. Press   or   to change the system configuration to PROGRESSIVE FLOW . |
| PROGRESS FLOW
MASTER | 6. Press  to specify Unit 1 as the master unit that controls Unit 2. |
| PROG FLOW TRIP
9 | 7. Press   or   to change the progressive flow trip point. |
| BLOCKING VALVE
INTERNAL | 8. Press   or   to set the blocking valve to INTERNAL if using a progressive flow gearbox and U-tube connector. See page <?>. Select EXTERNAL when installing with blocking valves. |
| Softening
JAN-01-12 12:29P | 9. Press    to save the settings and display the HOME screen. |

Quick Reference—Modem Control Valve

For a High Efficiency 1.5 Twin Softener with Meter

- Hardness: 20 gpg
- Downflow regeneration
- Modem connected in control

NOTE The HE 1.5 Twin softener installation may require additional steps depending on which accessories are connected. Follow the installation procedure prior to first time setup, including: softener placement; tank assembly; control valve mounting; bypass valve installation; plumbing connection; modem installation, programming, and testing; remote display installation; and start up. After installation, run First Time Setup.

Set Up Remote Display/Control Valve

- | | |
|---|---|
| Softening
JAN-01-12 12:29P | 1. From the HOME screen, press to view the main menu. |
| 1) INFORMATION
2) MANUAL MODE
3) SET DATE/TIME
>4) ACCESSORIES | 2. The screen displays the main menu. Press to select 4) ACCESSORIES. |
| 4) AUX OUTPUTS
5) SBT SENSOR
6) WIRELESS REM
>7) MODEM | 3. Press to select 7) MODEM. |
| TEL MODEM
NOT INSTALLED | 4. Press to change the state to installed if a telephone modem is installed inside the Smart Controller. |
| MODEM LOCATION
IN MAIN CONTROL | 5. Press to change the location. |
| CALL FREQUENCY
EVERY 10 REGENS | 6. Press or and then to increase or decrease the frequency if necessary. |
| TIME ZONE GMT
-6:00 | 7. Press or and then to change the time zone. |
| DEALER ID
>_ | 8. Press or and then to change each digit of the dealer ID. When the final digit is entered press to accept the entire dealer ID. |

DATA PHONE #
18884137028

9. Press or and then to change each digit of the phone number. When the final digit is entered press to accept the entire phone number.

Softening
JAN-01-12 12:29P

10. Press to display the **HOME** screen.


Test the Modem

- | | |
|---|--|
| Softening
JAN-01-12 12:29P | 1. From the HOME screen, press to view the main menu. |
| 3) SET DATE/TIME
4) ACCESSORIES
5) ADV. SETUP
>6) DIAGNOSTICS | 2. Press to select 6) DIAGNOSTICS.. |
| 6) AUX OUT STAT
7) AUX OUT TEST
8) USE DATA PORT
>9) TEST PHONELIN | 3. Press to select 9) TEST PHONELIN. |
| MODEM TEST
Emailing now
Please Wait... | 4. The screen displays the status of the test before displaying the results. |
| MODEM EMAIL
SUCCESS | 5. Do not press any buttons before the test is complete or the controller will return to the Diagnostics menu. |
| Softening
JAN-01-12 12:29P | 6. Press to display the HOME screen. |

Quick Reference—Smart Brine Tank Probe For a High Efficiency 1.5 Twin Softener with Meter


- Hardness: 20 gpg
- Smart Brine Tank Probe connected
- 18" Brine Tank is used (375 lb. capacity)
- No default settings need to be changed

NOTE The HE 1.5 Twin softener installation may require additional steps depending on which accessories are connected. Follow the installation procedure prior to first time setup, including: softener placement; tank assembly; control valve mounting; bypass valve installation; plumbing connection; and start up. After intallation, run First Time Setup and then setup the Smart Brine Tank Sensor.





NOTE In order for proper probe functioning, it is required that prior to selecting INSTALLED on the menu the probe must be physically installed into the brine tank and that the brine tank be filled with a minimum of 16" depth of salt. Failure to take these steps will result in the screen displaying ERROR MESSAGE. If these steps were not followed, go to the menu shown below and select UNINSTALLED, then press  and return to the HOME SCREEN. Once the probe is installed correctly and salt is added to the brine tank, return to these menus and change the setting to INSTALLED.

Set Up Remote Display/Control Valve

Softening
JAN-01-12 12:29P

1. From the **HOME** screen, press  to view the main menu.

SALT GEOMETRY
Pellet/Cube

6. Press   or  and then  to change the salt geometry (the shape of the softening salts).

1) INFORMATION
2) MANUAL MODE
3) SET DATE/TIME
>4) ACCESSORIES

2. The screen displays the main menu. Press     to select **4) ACCESSORIES**.




Softening
JAN-01-12 12:29P

7. Press   to display the **HOME** screen.





2) BEEPER
3) AUX IN
4) AUX OUTPUTS
>5) SBT SENSOR

3. Press      to select **5) SBT SENSOR**.

SBT SENSOR
NOT INSTALLED

4. Press    to change the state to installed. The HE 1.5 Controller can then communicate with the SBT sensor.

TANK DIAMETER
16
INCHES

5. Press   or  and then  to increase or decrease the tank diameter, which is used to estimate the number of days the brine tank has salt.

Culligan 16" brine tank = 250 lb. salt capacity
Culligan 18" brine tank = 375 lb. salt capacity
Culligan 24" brine tank = 650 lb. salt capacity.

Quick Reference—Aqua-Sensor® Application

For a High Efficiency 1.5 Twin Softener with Aqua-Sensor and Meter

- Hardness: 20 gpg
- No other accessories connected
- No default settings need to be changed

NOTE The HE 1.5 Twin softener installation may require additional steps depending on which accessories are connected. Follow the installation procedure prior to first time setup, including: softener placement; tank assembly; control valve mounting; bypass valve installation; plumbing connection; Aqua-Sensor probe installation; and start up. After installation, run First Time Setup, program the Aqua-Sensor accessory, and program the Soft-Minder meter as a backup to the Aqua-Sensor probe. Reduce reserve capacity to approximately 10%, OR use the Aqua-Sensor probe to initiate regeneration 100% of the time (the conditioner will still monitor flow-related data such as flow rate, average water usage, etc.)

Set Up Aqua-Sensor

- Softening
JAN-01-12 12:29P
- From the **HOME** screen, press to view the main menu.
- 1) INFORMATION
2) MANUAL MODE
3) SET DATE/TIME
>4) ACCESSORIES
- The screen displays the main menu. Press to select **4) ACCESSORIES**.
- >1) AQUASENSOR
2) BEEPER
3) AUX IN
4) AUX OUTPUTS
- Press to select **1) AQUASENSOR**.
- AQUASENSOR
NOT INSTALLED
- Press to change the state to installed.
- AQUASENSOR DEBUG
OFF
- Keep this setting at **OFF**. Press to return to the accessories menu.
- Softening
JAN-01-12 12:29P
- Press to display the **HOME** screen.

RESERVE CAPACITY
10%
(316 GAL)

- Press to advance to the **RESERVE CAPACITY** setting. For a single HE 1.5 softener the typical setting is 30 percent reserve capacity. Press or to change the value to 10.
- Press to display the **HOME** screen.

Use A/S to Initiate 100% Regeneration

- Softening
JAN-01-12 12:29P
- From the **HOME** screen, press to view the main menu.
- 2) MANUAL MODE
3) SET DATE/TIME
4) ACCESSORIES
>5) ADV. SETUP
- From the main menu, press to select **5) ADV. SETUP**.
- 1) SYSTEM SETUP
2) REGEN SETUP
3) CYCLE TIMES
>4) REGENTRIGGER
- Press to select **4) REGENTRIGGER**.
- FLOW METER
CANNOT TRIGGER
- Press or to change the value to **CANNOT TRIGGER**.
- Softening
JAN-01-12 12:29P
- Press to display the **HOME** screen.

Set Up Soft-Minder as A/S Backup

- Softening
JAN-01-12 12:29P
- From the **HOME** screen, press to view the main menu.
- 2) MANUAL MODE
3) SET DATE/TIME
4) ACCESSORIES
>5) ADV. SETUP
- From the main menu, press to select **5) ADV. SETUP**.
- 1) SYSTEM SETUP
>2) REGEN SETUP
3) CYCLE TIMES
4) REGENTRIGGER
- Press to select **2) REGEN SETUP**.





















Quick Reference—Remote Display

For a High Efficiency 1.5 Twin Softener with Meter














- Hardness: 20 gpg
- Downflow regeneration
- Remote display connected

NOTE The HE 1.5 Twin softener installation may require additional steps depending on which accessories are connected. Follow the installation procedure prior to first time setup, including: softener placement; tank assembly; control valve mounting; bypass valve installation; plumbing connection; remote display installation; and start up. After installation, run First Time Setup.

Set Up Aqua-Sensor

- | | |
|---|---|
| Softening
JAN-01-12 12:29P | 1. From the HOME screen, press  to view the main menu. |
| 1) INFORMATION
2) MANUAL MODE
3) SET DATE/TIME
>4) ACCESSORIES | 2. The screen displays the main menu. Press     to select 4) ACCESSORIES . |
| 3) AUX IN
4) AUX OUTPUTS
5) SBT SENSOR
>6) WIRELESS REM | 3. Press       to select 6) WIRELESS REM . |
| REMOTE DISPLAY
NOT INSTALLED | 4. Press    to change the state to installed. The Smart Controller can then communicate with the remote. |
| CHANNEL #
>1 | 5. Press   or   to select the channel number of the control valve. The channel number must be the same on the controller and the remote. |
| RF FREQUENCY
915 MHz | 6. Do not change the RF FREQUENCY setting in North American installations. |
| Softening
JAN-01-12 12:29P | 7. Press   to display the HOME screen. |

Check Signal Strength

- | | |
|---|--|
| Softening
JAN-01-12 12:29P | 1. From the HOME screen, press  to view the main menu. |
| 3) SET DATE/TIME
4) ACCESSORIES
5) ADV. SETUP
>6) DIAGNOSTICS | 2. Press       to select 6) DIAGNOSTICS . |
| 1) ADVANCED STAT
2) CHECK SENSORS
>3) TEST WIRELESS
4) TEST PROGFLOW | 3. Press    to select 3) TEST WIRELESS . |
| WIRELESS TEST
0 / 14
RSS=5 | 4. The signal strength indicator (SSI) displays a value between zero (0) and 8. If the SSI is at least 4 then the installation is complete. Change the location of the remote (i.e. close to the HE 1.5 Twin Softener) to improve the signal, if necessary. |
| Softening
JAN-01-12 12:29P | 5. Press    to display the HOME screen. |

Appendix E Data Port Output

Culligan Smart Controller—Data Port Output

The Smart Controller (GBE) is used to control water softeners, filters and commercial RO systems. This controller has the ability to provide status messages to a customer's equipment using RS-232 and RS-485 communication protocols. These protocols are commonly used to send information from the Smart Controller to either a customer's PC or to a building management system or programmable logic controller (PLC). The information is one way in that the Smart Controller can send this information out, but the Smart Controller cannot receive or respond to any commands sent into the communication port. The Smart Controller sends a status message every 60 seconds. The information is sent as a short text (ASCII), comma separated string of letters and numbers.

The information contained in the status message depends upon what type of equipment is being controlled by the GBE.

Single Water Softener or Filter controlled by the Smart Controller

The format of the status message is: CULL,A,B,C,D,E,F,G

Example: CULL,00016524,000051.5,1,00000000,0x0000,1,0329101314

Where the values for the fields A thru F are as follows:

A = total gallons since new

B = current flow rate in gallons per minute (57.2 means 57.2 gallons per minute)

C = Current Status Indicator (0 = initialization, 1=service, 2=prerinse, 3=regen, 4= standby)

D = capacity remaining in gallons

E = Error Flag (see below)

F = 1

G = A ten-digit number representing the date and time (24-hour format)

Error Bit	Meaning
0	Internal Valve Leak
1	Salt Bridging Detected
2	Brine Line Blocked
3	Brine Tank Overfill Error
4	Replace Media Filter
5	No RF Remote Signal
6	AquaSensor Salt Error (possibly low salt or failed education)
7	Motor Homing Error
8	Motor Position Sensor Error
9	Low Salt Level in Brine Tank
10	(not used)
11	AquaSensor Probe Fault (probe has failed, not plugged in or AquaSensor transformer failed)
12	Less than 14 Days Salt

The error flag is sent as a hexadecimal number in the format 0xWXYZ as follows:

W				X				Y				Z			
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Each error bit is either 0, meaning that this error is NOT present, or 1, meaning that this error IS present. Each of the four-bit sections (W, X, Y and Z) are then combined into a four digit binary word which is converted to a hexadecimal digit.

As an example, if there are no errors present, then the value would be 0x0000.

If there were a 'Replace Media Filter', 'AquaSensor Salt Err' and 'Motor Position Sensor Error' present then bits 4, 6 and 8 would be set to 1 and all other bits would be 0, respectively.

	W				X				Y				Z			
Error Bits	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Binary	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0
hexadecimal	0				1				5**				0			
Error Flag	0x0150															

*Note that the first two characters of the error flag are always "0x" to signify that this is a hexadecimal number

** In hexadecimal, the number 4 bit equals 1, the number 5 bit equals 2, the number 6 bit equals 4, and the number 7 bit equals 8. Therefore, when you add the #4 bit value to the #1 bit value, you get 5.

So the value of the error flag would be 0x0150 if these three errors were present.

NOTE If the GBE is controlling a filter (instead of a water softener) then the above message definitions are identical, but that error flags 1,2,3,6,9 and 11 will always be zero for a filter.

Progressive Flow System of Smart Controller-Controlled Water Softeners

The format of the status message for a progressive flow network consists of a series of individual lines of information, one line for each of the Smart Controller-controlled softeners. For example, in a triplex progressive flow network, every 60 seconds, the data port on the master unit will send out the following three lines of information:

CULL,A1,B1,C1,D1,E1,1,G1

CULL,A2,B2,C2,D2,E2,2,G2

CULL,A3,B3,C3,D3,E3,3,G3

example:

CULL,00052754,000003.7,1,00009110,0x0000,1,0329101314

CULL,00042674,000003.5,1,00004321,0x0000,2,0329101314

CULL,00010204,000000.0,4,00005444,0x0000,3,0329101314

The 1 at the end of the first line indicates that this line is the status for the Master unit in the progressive flow network. The 2 and 3 on the subsequent lines indicate that this data is for slave unit #1 and slave unit #2, respectively. The information contained on each line is of the same format as described in the Single softener section above.

Electrical Connections

The Culligan Data Cable Connector is terminated with a D-sub9 style female termination. The customer must provide the following pin connections:

Pin	Function
3 (Input)	TD (data coming FROM the GBE board)
2 (Output)	RD (this line is required even though no data is sent TO the GBE board)
7 (Input)	RTS
8 (Output)	CTS
5 (Signal gnd)	GND

The data coming from the Smart Controller board is at the following conditions:

Bits Per Second: 9600

Data Bits: 8

Parity: None

Stop Bits: 1

Flow Control: None

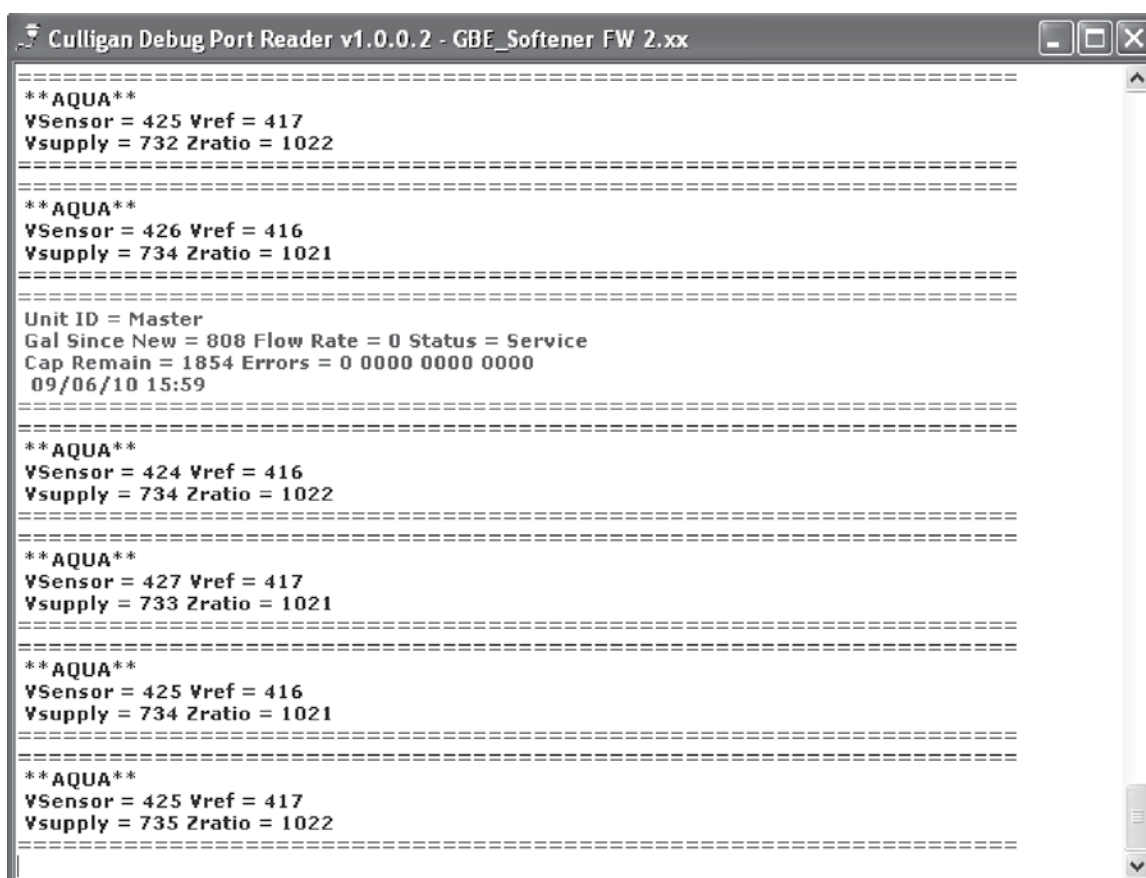
Refer to "Accessories Parts List" on page 118 for a list of cables currently available.

Test the Data Port

The Culligan Smart controller is capable of communicating with many different types of equipment including laptop and desktop computers running Microsoft Windows® operating systems. In order to connect the Smart Controller to a computer you will need a USB-to-GBE cable, Culligan P/N 01021507. You will also need to download a installation file from the myCulligan Web site on the GBE downloads page. The file is called "Setup_Culligan_GBE.EXE". Once you copy the file to your PC, you can double-click on the file to install the USB drivers and the Data Port Output Viewer to your local hard drive. You will be asked which directory you want to copy these files to. You may select any directory. Note: Previous instructions showed how to view the output in Windows' Hyperterminal. Although this is still possible, this program makes the process much more simple.


The instructions for using the program are included with the download. The program is a simple viewer window that shows the decoded messages sent to the debug port. See figure below.

The following pages describe how to send a mini report to the viewer.









Send a Test Message from the Smart Controller

SOFTENING
JAN-01-11 12:01P

1. From the **HOME** screen, press  to view the main menu.

3)SET DATE/TIME
4)ACCESSORIES
5)ADV. STATS
>6)DIAGNOSTICS

2. The screen displays the main menu. Press  to select **6)DIAGNOSTICS**.



5)MOTOR CONTROL
6)AUX OUT STAT
7)AUX OUT TEST
>8)USE DATA PORT

1. From the diagnostics menu, press  to select **8)USE DATA PORT**. The controller will attempt to send a mini-report to the data port.

Mini Report:
Sending...

2. The Smart Controller sends a test message to the hyperterminal screen that generates a Mini Report. See Figure 79.

Mini Report:
Sent...

3. The screen indicates when the report has been sent to the data port.
4. Press  to return to the diagnostics menu.

*** MINI REPORT ***

SN = 00000041	Pressure = HIGH
FW Version = FWR210LT01	Salt type = NaCl
Valve Type = 4-CYCLE	Resin type = std
Date = 4/30/10	BF Flow control = 0.45 GPM
Time = 11:00	Eductor Flow control = 32.0
Total = 0 GAL	Reserve capacity = 10 %
regen 14d = 0	flow meter trig = yes
trigger = Manual	aquasensor trig = no
type = softener	regen interval = 0
hardness units = US	predict mode = no
Hardness = 26 grains	day of week mode = none
Resin = 1.00 cu/ft	brine type = Downflow
avg mon = 300 GAL	pre-rinse mode = no
avg tue = 300 GAL	prerinse after 24 hours
avg wed = 300 GAL	prerinse for 5 mins
avg thr = 198 GAL	units = US
avg fri = 300 GAL	A/S = not installed*
avg sat = 300 GAL	SBT = not installed*
avg sun gal = 300 GAL	Flow Profile R1 = 0
bw time = 1 min	Flow Profile R2 = 0
BD rinse = 1 min	Flow Profile R3 = 0
F rinse = 10 min	Flow Profile R4 = 0
Fill = 60 sec	Flow Profile R5 = 0
Dosage = 9.0 LBS	Flow Profile R6 = 0
DAS = SOFTEST	
Iron = 0 PPM	

* Softener only.

Figure 80. Mini Report from data port.

Culligan® Softener and Filter Program Log

Cat. No. 01022883

Rev. C 02/15/12

DCO # 012950

Use this log to record the program settings for any Smart Controller (GBE) controlled softener (S) or filter (F). Circle or enter the observed value. Make additional copies to keep on file near the installation and with your local Culligan dealer.

Program Date: _____ Installer: _____ Site Location: _____

Smart Controller ESN: _____ Firmware Version: _____ ☐ Softener ☐ Filter

Regeneration Initiation (check all that apply): ☐ Time Clock ☐ Meter ☐ Aqua-Sensor ☐ Other

First Time Setup

NOTE C=Commercial, R=Residential
S=Softener, F=Filter

Month		
Day		
Year		
Clock Type	12 Hr/24 Hr	
Hour		
Minutes		
Unit Type	Softener/Filter/ Resin+Carbon	
Valve Type	HE 1, HE 1.25, HE 1.5, HE 1 Twin, HE 1.5 Twin, 4-Cycle, 5-Cycle, Plat Plus	
Units	US Inch/Metric	
Install Type	Residential, Commercial	S Only
Brining Type	Downflow, Upflow, Proportional	S Only
Tank Diameter		
Hardness		
Brine Draw-Rinse		SC Only
Fill Time		SC Only
Media Life		FR Only
Total Capacity		

Regeneration Setup

Salt Dosage		S Only
Total Capacity		
Reserve Capacity		S Only
Brining Type		S Only
Time of Regen		
Regen Mode	Delayed/Immediate	
Power Up Regen		
Regen Lockout		S Only
Media Life		F Only

Cycle Times

Backwash		
Brine Draw-Rinse		
Fast Rinse Time		
Fill Time		

Regeneration Triggers

Flow Meter	Can/Cannot	
Aqua-Sensor	Can/Cannot	S Only
Regen Interval		
Predict Mode	OFF/ON	S Only
Regen On	(Day of Week)	

Accessories, cont.

Aux1 Output Type	Normally On Normally Off Repeat Cycle Time Interval	
Aux1 Valv Pos/Pulse Mode/Start Time		
Aux1 Out Delay		
Aux1 Out Active		
Aux1 Out Off		Repeat Cycle
Aux2 Output Type	Normally On Normally Off Repeat Cycle Time Interval	
Aux2 Valv Pos/Pulse Mode/Start Time		
Aux2 Out Delay		
Aux2 Out Active		
Aux2 Out Off		Repeat Cycle
Aux3 Output Type	Normally On Normally Off Repeat Cycle Time Interval	
Aux3 Valv Pos/Pulse Mode/Start Time		
Aux3 Out Delay		
Aux3 Out Active		
Aux3 Out Off		Repeat Cycle
SBT Sensor	Installed/Not Installed	S Only
BR Tank Diameter		S Only
Salt Geometry	Pellet/Rock/ Block/Special	S Only
Wireless Remote	Installed/Not Installed	
Channel #		
Radio Frequency	915	
Modem	Installed/Not Installed	
Modem Location	Main Control/ In Remote	
Call Frequency		
Time Zone GMT		
Dealer ID		
Date Phone #		
Chlorinator	Installed/Not Installed	
Power Level		
On Time		
Flow Meter	Installed/Not Installed	
Puls/Gal		
Low Flow Limit		
High Flow Limit		
Service Phone #		
External Filter Alarm	Installed/Not Installed	S Only
Filter Capacity		S Only
Reset Capacity	Yes/No	S Only

Advanced Setup

Salt Type		
Iron ppm		
Line Pressure	Above/Below 40 psi	
Dial-A Softness	A, B, C, Softest	
Multitank System	Single Twin Progress Flow Alternating Unbal Prog Flow	
Progress Flow	Master/Slave (____)	
Prog Flow Trip		
Small Tank Trip		Unbal Pflow Only
Blocking Mode	Internal/External	
Prerinse Mode	OFF/ON	
Rinse If No Flow		
Rinse For		

On Remote Display

Remote Display	Installed/Not Installed	
Channel #		
Radio Frequency	915	

Accessories

Aqua-Sensor	Installed/Not Installed	S Only
Debug	ON/OFF	S Only
Beeper Mode	Always On Always Off 12 Hr. Warnings 24 Hr. Warnings	
Set Contrast	____ (1-5)	LCD Only
Aux Input	____ seconds	
Aux Input	Regen Trigger Ext. Alarm Regen Inhibit Bypass Mode*	*HE Only



Warning! If incorrectly installed, operated or maintained, this product can cause severe injury. Those who install, operate, or maintain this product should be trained in its proper use and warned of its dangers before attempting to install, operate or maintain this product.

Operation Log

Use the log provided to maintain a record of the system operation. This can be very helpful in identifying any operation problems or maintenance requirements.

[illegible]

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